Port Authority's "Asbestos Operations and Maintenance Course Training Manual," developed by Hygienetics Environmental Services, Inc.

ASBESTOS OPERATIONS AND MAINTENANCE COURSE

TRAINING MANUAL

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

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OPERATIONS AND MAINTENANCE COURSE

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INTRODUCTION

Welcome! This Initial Operations and Maintenance Course is part of Hygienetics' Operations and Maintenance Program Development Service. Designed for building maintenance workers and engineers who may contact asbestos during routine work activities, this course will provide instruction on fundamental concepts regarding the proper identification and correct response techniques to be implemented when confronted with asbestos issues.

Hygienetics developed this manual specifically for this course. Your instructor(s) will cover the topics roughly in the order presented here. There are outline pages in the back of each section for you to use for note taking.

This manual provides comprehensive information about asbestos. Additional information may be obtained from your employer, government agencies, industry publications or your local library.

Enjoy the Course!

GLOSSARY
FOR
OPERATIONS AND MAINTENANCE PERSONNEL

Abatement - any and all procedures physically taken to control fiber release from asbestos-containing materials (ACM). This includes removal, encapsulation, enclosure and repair.

ACBM - Asbestos-containing Building Material

Accessible ACM - ACM which is subject to disturbance by building occupants or custodial or maintenance personnel in the course of their normal activities.

ACM - Asbestos Containing Material

Actinolite - an asbestos fiber type that is green in color. It is quite hard and has low tensile strength and flexibility when compared to other types of asbestos. Actinolite has little industrial use.

Aggressive Sampling - Air sampling which takes place after final clean-up while the air is being physically agitated to produce a "worst case" situation.

Air Erosion - The passage of air over friable ACBM which may result in the release of asbestos fibers.

Air Lock - A system of enclosures consisting of two polyethylene curtained doorways that does not permit air movement between clean and contaminated areas.

Air Monitoring - The process of measuring the airborne fiber concentration of a specific quantity of air over a given amount of time.

Alveoli - air sacs in the lung tissues where the transfer of gases occurs between the lungs and the blood stream.

Amended Water - Water to which a chemical wetting agent (surfactant) has been added to improve penetration into asbestos-containing materials.

Amosite - a grey-to-brown fiber type having a coarse, needle-like crystal structure. Amosite is highly resistant to heat and chemical corrosion which led to its popular use as insulation in and on heating systems.

Anthophylite - a yellow-brown asbestos fiber type with poor flexibility and low tensile strength. Anthophylite has no major use in industry.

Approved Landfill - A site for the disposal of asbestos-containing and other hazardous wastes that has been given State or Municipal approval.

Area Air Sampling - any form of air sampling or monitoring where the sampling device is placed at some stationary location.

Asbestos - any hydrated mineral silicate separable into commercially usable fibers, including, but not limited to, chrysotile(serpentine), amosite(cuminstomite-grunerite), crocidolite(riebeckite), tremolite, anthophylite and actinolite.

Asbestos Containing Material (ACM) - any material that contains more than one percent asbestos by weight.

Asbestos Containing Waste Material - asbestos-containing material or asbestos-contaminated objects requiring disposal.

Asbestosis - A non-malignant, progressive, irreversible lung disease caused by the inhalation of asbestos dust and characterized by diffuse fibrosis.

Bronchi - Primary branches of the trachea (windpipe).

Chrysotile - a grey-to-white asbestos fiber type that is very long and flexible and easily woven into fabric. Chrysotile asbestos is used in over 90% of all industrial and commercial applications.

Cilia - tiny hair-like structures in the windpipe and bronchi of the lung passages that sweep undesirable particles up and out of the lungs.

Clearance Air Monitoring - the employment of aggressive sampling techniques with a volume of air collected to determine the airborne concentration of residual fibers upon conclusion of an asbestos abatement activity.

Clearance Criteria - an established level of acceptance for declaring an area that has undergone asbestos abatement work environmentally safe for reoccupancy.

Critical Barriers - sealed boundaries of the work area, existing or created, to prevent flow of asbestos contamination to air outside the work area. Examples include: sealed doors, windows, vent openings, HVAC supply and return. Common seals used are polyethylene, plywood, foam board, and duct tape.

Crocidolite - a blue-colored asbestos fiber resistant to chemical corrosion which led to its use in the manufacture of battery boxes, acid pumps, valves and gaskets.

Curtained Doorway - a device which consists of at least three overlapping sheets of plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top and left side, the second sheet at the top and right side, and the third sheet at the top and left side. All sheets shall have weights attached to the bottom to ensure that the sheets hang straight and maintain a seal over the doorway when not in use.

Decontamination Enclosure System - a series of connected rooms, separated from the work area and from each other by air locks, from the decontamination of workers, materials, waste containers and equipment.

Disposal Bag - a 6 mil. thick, leak-tight plastic bag used for transporting asbestos waste from the work site to the disposal site. All disposal bags should contain the required warning, which is permanently embossed or attached to the bag as a label.

Encapsulant (Sealant) or Encapsulating Agent - a liquid material which can be applied to asbestos-containing material (ACM) and which temporarily controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant). This may also be used to seal surfaces from which ACM has been removed.

Encapsulation - the treatment of asbestos containing materials with a penetrating or surface sealant in order to minimize the potential for asbestos fiber release.

Enclosure - An airtight, impermeable, permanent barrier around ACBM to prevent the release of asbestos fibers into the air.

E.P.A. - the U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

EL - Excursion Limit. The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 f/cc as averaged over a sampling period of thirty (30) minutes.

F/CC - Fibers per cubic centimeter of air.

Fixed Object - a unit of equipment or furniture in the work area which cannot be removed from the work area.

Friable Asbestos Material - any asbestos or any ACM that can be crumbled, pulverized or reduced to powder when dry, by hand pressure.

Glove Bag - Plastic bag-type enclosure placed around asbestos-containing pipe lagging so that it may be removed without generating airborne fibers into the atmosphere.

Ground Fault Interrupter - A device which automatically de-energizes any high voltage system component which has developed a fault in the ground line.

HEPA Filter - a High-Efficiency Particulate Air filter capable of trapping and retaining 99.97 percent of particles (asbestos fibers) greater than 0.3 micrometers in diameter.

HEPA Vacuum Equipment - vacuuming equipment with a HEPA filter.

Mesothelioma - A relatively rare form of cancer which develops in the lining of the pleura or peritoneum with no known cure.

Movable Object - a unit of equipment or furniture in the work area which can be removed from the work area.

MSDS - Material Safety Data Sheet

MSHA - the Mine Safety and Health Administration, Approval and Certification Center, P.O. Box 251, Route 1, Triadelphia, WV 26059.

Negative Pressure - An atmosphere created in a work enclosure such that the airborne fibers will tend to be drawn through the filtration system rather than leak out into the surrounding areas. The air pressure inside the work area is less than outside the work area.

NESHAPS - the National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

NIOSH - the National Institute for Occupational Safety and Health, 200 Constitution Avenue N.W., Washington, D.C. 20210.

NIOSH/MSHA - The official approving agencies for respiratory protective equipment who test and certify respirators.

Operations & Maintenance (O&M) - A program of specific procedures and practices developed for the interim control of asbestos-containing materials in buildings until it is removed.

OSHA - The U.S. Department of Labor, Occupational Safety and Health Administration which was created by the Occupational Safety and Health Act of 1970; serves as the enforcement agency for safety and health in the workplace environment.

PEL - Permissible Exposure Limit of 0.1 f/cc measured over an 8 hour Time Weighted Average as stated by OSHA.

Personal Air Monitoring - a method used to determine employees' exposure to airborne fibers. The sample is collected outside the respirator in the workers breathing zone.

Personal Protective Equipment (PPE) - appropriate protective clothing, gloves, eye protection, footwear, head gear and approved respiratory protection.

Plasticize (Poly) - to cover floors and walls with plastic sheeting or by using spray plastics to seal the work area.

Pulmonary Function Test - A part of the medical examination required to determine the health status of a person's lungs.

Qualitative Fit Test - the individual test subjects responding to a chemical challenge outside the respirator facepiece. Three of the most popular methods include: 1) irritant smoke test; 2) odorous vapor test; 3) taste test.

Quantitative Fit Test - exposing the respirator wearer to a test atmosphere containing an easily detectable, nontoxic aerosol vapor or gas as the test agent. Instrumentation, which samples the test atmosphere and the air inside the facepiece of the respirator, is used to measure quantitatively the leakage into the respirator. There are a number of test atmospheres, test agents, and exercises to perform during the tests.

Removal - the stripping of any asbestos containing materials from surfaces or components of a facility or the removal of structural components.

Respirator Program - A written program established by an employer which provides for the safe use of respirators on the job site.

Repair - The action of returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

Response Action - Method, including removal, encapsulation, enclosure, repair, and operations and maintenance, that protects human health and the environment from exposure to asbestos.

Routine Maintenance Area - An area, such as a Mechanical Room, that is not normally frequented by occupants and in which maintenance employees or contract workers regularly conduct maintenance activities.

Structural Member - any load supporting member of a facility, such as beams and load supporting walls, or any nonload supporting member, such as ceiling and nonload supporting walls.

Surfactant - the chemical wetting agent added to water to improve the capability of penetration, thus reducing the quantity of water needed during abatement.

Time Weighted Average (TWA) - the average concentration of a contaminant measured in the air during a specific time period.

Visible Emissions - any emissions containing particulate asbestos material that is visually detectable without the aid of instruments.

Wet Wiping - the method of eliminating asbestos containing material from surfaces and objects using cloths, mops or other cleaning utensils dampened with water. Such items are disposed of as asbestos-contaminated waste and are handled accordingly.

Work Area - designated rooms, spaces, or areas of the building or structure where asbestos abatement takes place.

Work Site - the premises where asbestos abatement activity is taking place.

BACKGROUND INFORMATION ON ASBESTOS

This section presents information regarding the geological formation and natural occurrence of asbestos minerals as well as an overview of the many uses of these materials throughout history.

OUTLINE

I. Asbestos Minerals

- A. Serpentine
- B. Amphibole

II. Properties of Asbestos

- A. Fireproof
- B. Chemical Resistance
- C. Tensile Strength
- D. Nonconductivity

III. Uses of Asbestos

- A. Past
  1. Historical Uses
  2. Surfacing Materials
  3. Thermal System Insulation
  4. Miscellaneous Materials
- B. Present
- C. Future

BACKGROUND INFORMATION ON ASBESTOS

INTRODUCTION TO ASBESTOS

Asbestos is a general term for several types of naturally-occurring fibrous minerals. These minerals are divided into two groups: Serpentine and Amphibole.

The Serpentine group of fibers are characterized as being snakelike in appearance. The type of asbestos found in this group is called Chrysotile. The amphibole group of fibers are straighter in appearance. The types of asbestos found in this group are crocidolite, amosite, actinolite, tremolite and anthophyllite. All six fibers in both mineral groups share several common properties:

- high tensile strength;
- chemical and heat resistance;
- nonflammability; and
- the tendency to split into smaller and smaller fibers when handled.
- aerodynamic

The three most common types of asbestos are chrysotile, amosite and crocidolite.

- Chrysotile, commonly called white asbestos, is the most common type, accounting for approximately 90% of the world's production and use. It has a very high tensile strength and is easily spun into woven fabric.

- Amosite, also called brown asbestos, is named for the acronym A(sbestos) M(ines) O(f) S(outh Africa). Amosite fibers are straighter, harder fibers with a great deal of flexibility.

- Crocidolite, or blue asbestos, is similar to chrysotile in its properties and has a higher resistance to acids.

GEOGRAPHICAL LOCATION, FORMATION AND THE MINING PROCESS

Asbestos is found in nearly every country in the world. Chrysotile or white asbestos is found in large deposits throughout the world and is mined mostly in Canada and the USA. Amphiboles are more common but rarely occur in deposits large enough to be used economically. Crocidolite and amosite are mined mostly in Australia and South Africa.

The two mineral groups (Serpentine and Amphibole) are formed differently in nature. Chrysotile is formed in fissures in serpentine rocks as a result of water dissolving the rock. On the other hand, amosite and crocidolite form in sedimentary rocks as a result of heat and pressure. The rocks are taken from the ground and transported to a mill. At the mill, the asbestos fibers are taken from the rock and are purified and processed. This processed asbestos is shipped to various industries to be incorporated into prefabricated items such as gaskets, pipe insulation, filters or shingles. It has also been sold in its powder form to be mixed with various materials on site for application as a sprayed-on insulation, acoustical or decorative material. The remaining rock, "tailings", contains small amounts of asbestos and have been mixed with asphalt for road surfaces.

HISTORY OF THE USES OF ASBESTOS

Asbestos was once known as the "miracle fiber" because it had so many good uses. It has been found in thousands of products. The oldest known use of asbestos has been found in Stone Age pottery in Africa and in Finland circa 2,500 B.C. Throughout the ages, the nonflammable properties of asbestos were discovered and used by small populations around the world. During the first century B.C., asbestos was used in "perpetual" wicks of oil burning lamps. Asbestos was also woven into funeral cloth for cremation. An emperor from the Holy Roman Empire (Emperor Charlemagne) was said to have had an asbestos tablecloth which he would throw into the fire. The food and wine stains would burn off but the tablecloth remained intact, and was actually whiter than it had previously been. This was said to have frightened his enemy warriors, convincing them that he had magical powers. Marco Polo encountered asbestos in his travels in Siberia under the name "Salamander's wool", and Benjamin Franklin's salamander's wool purse was placed in a British Museum in 1753. Pipe Pious IV produced asbestos paper in 1830 so papal documents could not be destroyed by fire. In Canada, a man was banished from his village because he had a pair of asbestos socks which he would throw into the fire and clean. This frightened villagers, who thought he had magical powers.

With the advent of the Industrial Revolution, there was a great need for an insulating material for machinery in factories. At the same time, asbestos deposits were being discovered.

The asbestos industry boomed during the years 1940-1970, resulting in hundreds of products containing asbestos. Two terms commonly referred to are ACM and ACBM. ACM stands for Asbestos-Containing Material and ACBM stands for Asbestos-Containing Building Materials. Some regulations may distinguish between the two terms.

The following is a partial list of ACM's and ACBM's that have been manufactured in the past:

- fireproofing materials: sprayed-on building structures or woven in theater curtains, firemen's clothes, welders' blankets;
- thermal insulation: around pipes, ducts and boilers, in pot holders and chemists' gloves, as spray-on materials;
- acoustical insulation: both sprayed in buildings and contained in ceiling tiles;
- electrical insulation;

- reinforcing material: in asbestos cement (transite, roofing panels, asbestos shingles, and water pipes), floor tiles, paint, caulk, patching compounds, decorative plaster and stucco, and asphalt
- friction materials: brake linings and clutch facings; and
- filters: for food, beverages, chemical processes, cigarettes (especially involving acids, gas masks in World War II, even to filter air pollutants or dust in HVAC systems).

ASBESTOS IN BUILDINGS

If left alone in good condition, asbestos-containing materials in buildings pose little threat.

The uses we must be most concerned with are friable building materials. Friable means that the material can be crumbled, flaked, or powdered easily by hand pressure, releasing fibers into the air. The EPA (Environmental Protection Agency) has estimated that approximately 700,000 buildings in the United States contain friable asbestos. About 500,000 of those buildings are estimated to contain at least some damaged asbestos. Significantly damaged asbestos can be found in almost half of them.

Generally, significantly damaged areas, such as boilers and mechanical rooms, are not accessible to the public. However, maintenance workers may frequent these areas. Damaged friable asbestos present in a building may result in potential exposure to building occupants. Asbestos has the ability to stay afloat in the air for long periods of time and can be transported to other parts of the building by wind currents, HVAC systems or individuals carrying fibers on their clothing.

Intact, non-friable asbestos materials, such as vinyl asbestos floor tiles, generally do not pose a health threat. If a non-friable material is disturbed or damaged, then there is a potential for fiber release and exposure.

The only way to properly identify asbestos is by taking a bulk sample (piece or chunk of suspect material). This can only be done by an inspector. If one is not sure if a material is asbestos-containing, always assume the material is asbestos and take the proper precautions.

BACKGROUND INFORMATION ON ASBESTOS

What Is Asbestos?

Two Families of Asbestos Minerals

1.

2.

Six Types of Asbestos Minerals

1.

2.

3.

4.

5.

6.

Major Countries That Contain Natural Asbestos

Important Chemical and Physical Properties

Important Terms

Friable

Non-Friable

Uses of Asbestos

Past:

Present:

Future:

New Jersey Department of Health

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: ASBESTOS

CAS Number: See last page
DOT Number: UN 2212/UN 2590

Substance number: 0164
Date: 2/25/87 Revision: 1-87

HAZARD SUMMARY

* *Asbestos can affect you when breathed in.*
* Asbestos is a CARCINOGEN--HANDLE WITH *EXTREME CAUTION.*
* Repeated exposure can cause a disease called *Asbestosis* to develop, usually *20 or more years after exposure begins. Asbestosis* is a scarring of the lungs that causes changes on chest x-ray, and *shortness* of breath with exertion. *Progression* of *Asbestosis* can lead to disability and death. The earlier exposure is stopped, the better the chance of *stopping serious disease later.*

IDENTIFICATION

Asbestos is the common name for a group of mineral fibers that range in color from white, green, brown, or blue. It is used as a fireproofing and insulating agent and in brake linings.

REASON FOR CITATION

* Asbestos is on the Workplace Hazardous Substance List because it is regulated by OSHA and cited by NIOSH, ACGIH, IARC, NTP and CAG.
* This chemical is also on the Special Health Hazard Substance List because it is a CARCINOGEN.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

* *Exposure to hazardous substances should* be routinely evaluated. This may include collecting personal and area air *samples. You can obtain copies of sam*pling results from your employer. You have a legal right to this information under *OSHA 1910.20.*
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

These exposure limits are for fibers longer than 5 micrometers.

OSHA: The legal airborne permissible exposure limit (PEL) is 0.2 *fibers/cc averaged over an 8-hour* workshift.

PEOSH: The NJ PEOSH legal airborne exposure limit is 0.1 fibers/cc averaged over an 8-hour workshift, and 0.5 fibers/cc, not to be exceeded during any work period.

NIOSH: The recommended airborne exposure limit is 0.1 fibers/cc averaged over an 8-hour workshift.

ACGIH: The recommended airborne exposure limits are for:
Amosite 0.5 fibers/cc
Chrysotile 2.0 fibers/cc
Crocidolite 0.2 fibers/cc
Other forms 2.0 fibers/cc
averaged over an 8-hour workshift.

* Asbestos is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of Asbestos chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* A regulated, marked area should be established where Asbestos is handled, used, or stored.
* Wear protective work clothing.
* Wash thoroughly at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of Asbestos to potentially exposed workers.

This Fact Sheet is a summary source of information for workers, employers, and community residents. Health professionals may also find it useful. If this substance is part of a mixture, this Fact Sheet should be used along with the manufacturer-supplied Material Safety Data Sheet (MSDS).

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to Asbestos:

* There are no known acute effects. People who develop serious and fatal disease later in life may feel fine at the time of exposure.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to Asbestos and can take months or years to develop:

Cancer Hazard

* Asbestos is a CARCINOGEN in humans. It has been shown to cause lung cancers (including *Mesothelioma*) as well as stomach, colon, rectal, vocal cord and kidney cancers.
* Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health, Asbestos has been tested and has not been shown to adversely affect reproduction.

Other Long-Term Effects

* Repeated exposure to Asbestos can cause the disease *Asbestosis*, a scarring of the lungs. The higher the exposure, and the longer the time of exposure, the more chance there is of serious illness.
* *Asbestosis* develops some years (from seven to thirty) after the period of exposure. It can progress to disability and death.
  Symptoms of *Asbestosis* include shortness of breath on exertion and changes on the chest x-ray.

MEDICAL

Medical Testing

Before beginning employment and at regular times after that, the following are recommended:

* Lung function tests (annually).
* New Jersey Public Employee Occupational Safety and Health Act requires that employees with significant historical direct exposure receive a chest x-ray every 5 years for the first 15 years, then every 2 years until 20 years after first exposure, and yearly thereafter. Private sector employees have a slightly different schedule; refer to the new OSHA Standard 1910.1001.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are <u>not</u> a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.20.

Mixed Exposures

Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by Asbestos exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems. The risk of lung cancer may be as much as <u>92 times higher</u> for people with Asbestos exposure who smoke than for those without both exposures.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, ENGINEERING CONTROLS are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Specific engineering controls are required for this by OSHA. Refer to the OSHA Standard for General Industry : 1910.1001 and the OSHA Standard for Construction: 1926.58, which applies to the *Asbestos Abatement Industry* (Federal Register Vol. 51, No. 119 June 20, 1986 Rules and Regulations.) Also refer to the NIOSH criteria document: Occupational Exposure to *Asbestos #77-169*.
* New Jersey PEOSHA, NJAC 12:100-12.6 requires the use of an enclosed, two hand glove system for brake and clutch repair and substitution with non-Asbestos brakes.
* Substitute the less toxic *mineral wool* and *fiberglass* for Asbestos where possible. There are substitutes for almost every use of Asbestos.
* There are extensive recommended and required engineering and procedural regulations for construction and repair projects involving Asbestos material. Before disturbing any Asbestos containing materials . Contact the NJ DOH for more information. Under OSHA and NJ PEOSHA all workers must receive special training by law.

Good WORK PRACTICES can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by Asbestos must change into clean clothing.
* Do not take contaminated work clothes home. Family members could be exposed.
* Wash any areas of the body that may have contacted Asbestos.
* Do not eat, smoke, or drink where Asbestos is handled, processed, or stored, since Asbestos can be swallowed. Wash hands carefully before eating or smoking.
* Ongoing Asbestos abatement projects in sealed areas become very hot and humid. There is a risk of heat stress. You should be trained by your employer to recognize the warning signs and the proper action to take to avoid seriously dangerous working conditions.
* Do not dry sweep for clean-up. Use a vacuum or a wet method to reduce dust during clean-up.
* When vacuuming, a high efficiency particulate absolute (HEPA) filtered vacuum should be used, <u>not</u> a standard shop vacuum.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with Asbestos. Wear protective gloves and clothing. Protective gloves and clothing should be impenetrable to Asbestos.
* Contaminated, disposable work clothes should be disposed of with Asbestos waste.
* Non-disposable clothing should be placed in plastic bags for laundering or decontamination by the employer.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* At any exposure level, use a MSHA/NIOSH approved combination respirator which includes a Type-C supplied-air respirator with a full facepiece operated in the pressure-demand mode and with either emergency HEPA backup filter or auxiliary self-contained breathing apparatus operated in the pressure-demand mode. [Caution: This type of respirator is not to be confused with demand or continuous flow Type-C supplied air respirators, which are not recommended.] Alternatively, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in the pressure-demand mode.
* However, during asbestos abatement projects when it is impossible to use supplied air or self-contained breathing apparatus, use a full facepiece powered air purifying respirator with high efficiency particulate filters.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems.

Q: Don't all chemicals cause cancer?
A: No. Most chemicals tested by scientists are not cancer-causing.

HANDLING AND STORAGE

* Prior to working with Asbestos you must be, by law trained on its proper handling and storage.
* A regulated, marked area should be established where Asbestos is handled, used, or stored.
* Airborne Asbestos dust is very difficult to remove. It is therefore essential that any area where Asbestos is handled be enclosed and isolated. The material should be kept wet with special surfactants and water.
* Enclose operations and use local exhaust ventilation with negative pressure air filtration and high efficiency particulate filters in areas of Asbestos removal. If enclosure with containment "glove" bags is not used for minor repairs, respirators must be worn and proper procedures must be followed.
* All Asbestos materials must be removed and disposed of according to regulations. The area must be monitored to ensure airborne Asbestos levels are below limits prior to reoccupation of the area where Asbestos was disturbed.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

CAG is the Carcinogens Assessment Group of the federal EPA.

A carcinogen is a substance that causes cancer.

The CAS number is assigned by the Chemical Abstracts Service to identify a specific chemical.

A combustible substance is a solid, liquid or gas that will burn.

A corrosive substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A fetus is an unborn human or animal.

A flammable substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The flash point is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A miscible substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A mutagen is a substance that causes mutations. A mutation is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A reactive substance is a solid, liquid or gas that can cause an explosion under certain conditions or on contact with other specific substances.

A teratogen is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The vapor pressure is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>>> E M E R G E N C Y I N F O R M A T I O N <<<<<<<<<<<<<<<<

Common Name: ASBESTOS
DOT Number: UN 2212/UN 2590
T Emergency guide code: 31

WARNING

DOES NOT BURN
CARCINOGEN
Health hazards on front page

FIRE HAZARDS

* Extinguish fire using an agent suitable for type of surrounding fire. Asbestos itself does not burn.
* Care should be taken to contain Asbestos materials disturbed in a fire.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If Asbestos is spilled or damaged take the following steps:

* Restrict persons not wearing protective equipment from area of spill until clean-up is complete.
* Proper procedures for repair or removal of the material must be followed by trained personnel.
* Spills and damaged Asbestos material MUST be cleaned using wet methods. DO NOT DRY SWEEP or SHOVEL.
* It may be necessary to contain and dispose of Asbestos as a HAZARDOUS WASTE. Contact the NJ Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

FOR LARGE SPILLS AND FIRES immediately call your local fire department. You can also request emergency information from the following:

DEP HOTLINE: (609) 292-7172
CHEMTREC: (800) 424-9300

HANDLING AND STORAGE (See page 4)

FIRST AID

NJ POISON INFORMATION 1-800-962-1253

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

OTHER COMMONLY USED NAMES

Asbestos may be a common name for any combination of the following:

Asbestos, Crocidolite
CAS # 12001-28-4
Asbestos, Anthrophyllite
CAS # 77536-67-5
Asbestos, Amosite
CAS # 12172-73-5
Asbestos, Chrysotile
CAS # 12001-29-5
Asbestos (no specification)
CAS # 1332-21-4

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NEW JERSEY DEPARTMENT OF HEALTH
Right to Know Project
CN 368, Trenton, NJ 08625-0368
(609) 984-2202

HEALTH EFFECTS OF ASBESTOS EXPOSURE

This section will explore the functions and defenses of the respiratory system and present the various diseases and complications that may result from exposure to airborne asbestos.

OUTLINE

I. The Respiratory System

- A. Anatomy
- B. Physiology
- C. Defense Mechanisms

II. Asbestos-Related Diseases

- A. Cancerous
- B. Non-Cancerous

III. Detection of Disease

- A. Symptoms
- B. Medical Exams

IV. Treatment

V. Asbestos Related Studies

HEALTH EFFECTS ASSOCIATED WITH ASBESTOS EXPOSURE

Introduction

In this discussion, the routes of exposure and mechanisms of the respiratory system will be examined in order to explain the major diseases and complications associated with asbestos exposure. Furthermore, a compilation of current statistics, studies and articles are presented to introduce new theories, as well as attempts at risk assessment in the field of asbestos health-related illnesses.

Background

Historically, asbestos has been used sporadically throughout the ages. The first known knowledge of asbestos disease dates back 2000 years. Naturalists observing slaves who wove asbestos into textiles documented the development of shortness of breath. To prevent the inhalation of fibers, respirators were constructed from sheep bladders. During the turn of the century, medical experts began linking asbestos with types of diseases in people heavily exposed as a result of the mining, manufacturing, and installing of asbestos. Definite proof of disease did not occur until 1964. Dr. Irving Selikoff from the NY Academy of Sciences released the results of his study on shipyard workers. These workers installed asbestos onto ships primarily during World War II. The study proved that exposure to asbestos causes lung cancer and ASBESTOSIS.

It is important to realize that the majority of people who have developed an asbestos related disease were exposed many years ago when there were little if any dust controls used. These workers were frequently exposed to high concentrations of asbestos fibers each working day with little or no protection. This is called occupational exposure.

Latency Period

A latency period is the time between the first exposure to a substance and the development of a disease. The latency period for all the asbestos related diseases is long ranging between 10-40 years after initial exposure. On the other hand, the latency period for a common cold is 3-4 days.

Routes of Exposure

There are three main potential routes of entry for harmful substances to enter the body: through the nose (inhalation); through the mouth (ingestion); or through the skin (cutaneous). The primary route of exposure for asbestos is inhalation. The secondary route is ingestion. Asbestos has not been proven to enter the body through the skin. The diseases discussed in this section are primarily caused by the inhalation of asbestos fibers.

The Respiratory System

A brief discussion of the respiratory system will help in understanding these effects. As air is breathed into the body, it passes through the mouth and nose into the windpipe or trachea. The trachea splits into two smaller airways called the bronchi. Each bronchus divides into smaller and smaller tubes (bronchioles) that terminate into tiny air sacs called alveoli. In these air sacs, oxygen is absorbed into small blood vessels and waste gases such as carbon dioxide pass out of the blood and are exhaled.

The lung is divided into two halves and sits in the pleural cavity. This cavity and the outside of the lung have a Saran-wrap type lining. The pleura and lung linings are in contact with each other and are very moist. Just like two panes of glass with water between them, these linings slide easily across each other, but are very difficult to pull apart. Accordingly, as the chest cavity expands, the lungs expand and air rushes in. If these linings (mesothelia) were to become damaged, inhalation could not occur properly.

The respiratory system has several defense mechanisms against various air pollutants, which work together to keep the lungs clean. These defenses include:

a. nasal hairs - trap large dust particles
b. mouth - traps and moistens large dust particles
c. mucus - wet, sticky substance that coats the lining of the airways
d. cilia - hairlike projections that line the airways
e. macrophages - large cells that engulf and destroy foreign particles

As particles are inhaled, they are trapped on the mucus lining of the airways. These airways contain cilia that sweep mucus upward toward the throat where it is swallowed or expelled. Hot cigarette smoke paralyzes the cilia (20 minutes per cigarette) thereby shutting down the lungs defenses. When cilia cannot cleanse the lungs, air pollutants remain in the delicate tissues and may eventually cause damage. Asbestos fibers that are not expelled will cause scarring of the tissues. Therefore, cigarette smokers who are exposed to asbestos are at a greater risk for developing lung disease than non-smokers.

Inevitably, some air pollutants reach the tiny air sacs (alveoli). When this occurs, macrophages, sometimes called the lungs' garbage collectors, attempt to engulf the particle and destroy it. However, because asbestos is a chemically resistant mineral fiber, the macrophages are often

unsuccessful. Consequently, the macrophages die and scar tissue develops, resulting in a condition known as ASBESTOSIS.

Asbestosis

Asbestosis is a progressive scarring of the lung's air sacs. It is a restrictive lung disease that reduces the capacity of the lung. The most common symptom is shortness of breath. Asbestosis is prevalent among workers who have been heavily exposed to asbestos fibers over a long period of time. Thus, it has been recognized that there is a clear dose-response relationship between asbestos exposure and the development of this disease. This means that the greater the asbestos exposure the more likely ASBESTOSIS will develop. As with all diseases associated with asbestos exposure, it may take many years for the disease to develop. The typical latency period for ASBESTOSIS is 15-30 years. An Operations and Maintenance worker using safe work practices and protective equipment described in this manual will have a much smaller likelihood of developing asbestosis as a result of his or her work.

Lung Cancer

There are many causes of lung cancer, of which asbestos is only one. Lung cancer claims 20-25% of those who work with asbestos. Cigarette smoking also causes lung cancer. When you combine the two, the asbestos worker who smokes is estimated to be 90 times more likely to get lung cancer than a nonsmoker who has never worked with asbestos. As with asbestosis, there is a long latency period between initial exposure and the onset of lung cancer, typically 20-30 years. No safe level of asbestos exposure has been determined. The workers in past industrial situations wore little or no protective equipment; therefore, proper protection and safe work practices will substantially lessen the risk of asbestos workers getting lung cancer or other asbestos-related diseases.

Mesothelioma

The asbestos-related disease of greatest concern in asbestos abatement is mesothelioma. Fortunately, it is also the rarest. Although exposure to asbestos has been strongly related with most cases of mesothelioma, some cases may occur without asbestos exposure. Mesothelioma is a cancer of the chest cavity lining (mesothelium). Mesothelioma can also occur in the lining of the abdominal cavity. If it occurs in the chest cavity, it is called pleural mesothelioma. In the abdominal cavity, it is known as peritoneal mesothelioma. This type of cancer spreads very rapidly and is almost always fatal. The exact cause remains unknown. There does not appear to be any increased risk of mesothelioma for smokers and there does not appear to be a dose-response relationship between asbestos exposure and mesothelioma. Cases have been recorded where the

person's asbestos exposure has been limited, such as with Steve McQueen, the actor. As with the other diseases related to asbestos exposure, mesothelioma takes 30-40 years to develop after initial exposure.

Other Diseases

Several other diseases are found more often among persons exposed to asbestos than the normal population. These include cancer of the esophagus, stomach, colon, and pancreas, pleural plaques, pleural thickening, and pleural effusion. Again, the importance of using the proper work practices and protective equipment to minimize the occurrence of these diseases due to unnecessary asbestos exposure cannot be overemphasized.

Pleural Plaques

Pleural Plaques are calcifications found on the lining of the chest cavity. This warning sign will appear on chest X-rays. This is the most common non-cancerous complication of asbestos exposure.

Pleural Effusions

A buildup or accumulation of fluid between the pleura and the lung lining.

Detection of Disease

Diseases are either detected by the person experiencing symptoms or discomfort or by a physician during an office visit. The most common symptom of many respiratory problems is shortness of breath. Other symptoms may include; chest pain, excess mucus production, chronic cough, weight loss, fatigue, and coughing up blood.

Various medical exams are available to detect respiratory illness. A chest X-ray will show most abnormalities. A chest X-ray used to detect occupationally related diseases must be read by a B-Reader. A B-Reader is a physician specially trained and certified to detect disease caused by exposure to hazardous substances at the work place. The second exam is a Pulmonary Function Test (PFT). This test measures total lung volume and air movement into and out of the lungs. This test is important in detecting obstructive and restrictive diseases. A medical questionnaire is a series of questions asked of an individual. This is used in conjunction with the results of the other exams to establish as baseline health status. A routine physical exam completes the evaluation.

Treatment

Treatment of various respiratory diseases can be very difficult. The delicate structures of the lungs and their life giving functions make them susceptible to damage. The damage caused by asbestos-related diseases is often untreatable. The table below illustrates treatments available to date.

Asbestosis	None. Medication and oxygen are given to relieve symptoms.
Lung Cancer	Surgery, chemotherapy, radiation (early detection is very important).
Mesothelioma	None to date.

Asbestos-Related Studies

The following studies have been summarized to provide you with statistics relating to different occupations or exposures and the risk of developing disease.

Asbestos Associated Diseases in a Cohort of Cigarette Filter Workers - New England Journal of Medicine, November 2, 1989; J. Talcott, W. Thurber, A. Kantor, E. Gaensler, J. Danahy, K. Antman, F. Li

Significantly high rates of asbestos-related disease was found in a Massachusetts cigarette manufacturing plant. This factory used crocidolite asbestos in the production of cigarette filters from 1951-1957. The nature of the process was described as being a very dry, dusty one where the mechanical mixing of asbestos took place. This is an example of an occupational exposure.

Thirty-three (33) men involved in the production of the asbestos-containing filters were traced. To date twenty-eight (28) of these men have died. Indicated below is the breakdown.

	Cause of Death	Number	
Out of the five living	Lung Cancer	8	workers, four were
diagnosed as having	Mesothelioma	5	asbestosis, three were
recently diagnosed with	Other Cancers	2	cancer and two were
diagnosed as having	Asbestosis	7	lung cancer.

Twenty-five (25) of these men were smokers in their lifetime and all of the men who developed lung cancer smoked. This study attributed the excess death and disease rate to the nature of the

process (highly respirable dust) and the type of fiber (predominantly exposed to crocidolite asbestos which is more strictly regulated in other countries).

Domestic Asbestos Exposure, Lung Fibre Burden, and Pleural Mesothelioma in a Housewife, British Journal of Industrial Medicine, 1989; M. Hurcharek, Jr., Capotorto, J. Muscat

This study presents a case history of a non-smoking housewife who had no direct occupational exposure to asbestos. She died from Mesothelioma within a year of diagnosis. "Her only documented exposure to asbestos was by secondary exposure through laundering her husband's asbestos-contaminated work clothes."

Scientists examined the woman's lung content and compared it to other Mesothelioma cases with occupational exposures. The results suggest that "bystander's exposure" or household contamination in the past was similar to that found in industrial workplaces. In conclusion, scientists caution that the data indicates that secondary exposure can be significant and exposures associated with Mesothelioma should not be considered "light".

Because of the many uncertainties that exist, health officials, industrial hygienists, and governmental agencies have and will probably continue to exercise caution when discussing asbestos health risks and setting public policy.

EPA and other government officials are very concerned about asbestos exposure risks. They have recognized, however, that a thorough, independent review of existing knowledge must first be made so that we have a firm understanding of the issues and can then focus research towards clarifying them. They have therefore authorized the establishment of an independent national research program to be coordinated and directed by the Health Effects Institute-Asbestos Research (HEI-AR) in Cambridge, MA. Over the next three years, HEI-AR's research activities should resolve the controversial issues raised in the above articles and provide us with sound guidance on the management of asbestos in buildings.

SMOKING CESSATION INFORMATION

APPENDIX J TO 29 CFR 1926.1101

The following organizations provide smoking cessation information.

1. THE NATIONAL CANCER INSTITUTE

Office of Cancer Communications
National Cancer Institute
National Institutes of Health
Building 31, Room 10AZ4
Bethesda, MD 20892

Cancer Information Service (CIS) 1-800-4-CANCER

2. THE AMERICAN CANCER SOCIETY

American Cancer Society
3340 Peachtree Road, N.E.
Atlanta, Georgia 30026

1-404-320-3333

The American Cancer Society (ACS) is a voluntary organization composed of 58 divisions and 3,100 local units. Through "The Great American Smokeout" in November, the annual Cancer Crusade in April, and numerous educational materials, ACS helps people learn about the health hazards of smoking and become successful ex-smokers.

3. THE AMERICAN HEART ASSOCIATION

American Heart Association
7320 Greenville Avenue
Dallas, Texas 75231

1-214-750-5300

The American Heart Association (AHA) is a voluntary organization with 130,000 members (physicians, scientists, and laypersons) in 55 state and regional groups. AHA produces a variety of publications and audiovisual materials about the effects of smoking on the heart. AHA also has developed a guidebook for incorporating a weight control component into smoking cessation programs.

4. THE AMERICAN LUNG ASSOCIATION

American Lung Association
1740 Broadway
New York, NY 10019

1-212-245-8000

A voluntary organization of 7,500 members (physicians, nurses, and laypersons), the American Lung Association (ALA) conducts numerous public information programs about

the health effects of smoking. ALA has 59 state and 85 local units. The organization actively supports legislation and information campaigns for non-smokers' rights and provides help for smokers who want to quit, for example, through "Freedom From Smoking," a self-help smoking cessation program.

5. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Office on Smoking and Health
U.S. Department of Health and Human Services
5600 Fisher Lane
Park Building, Room 110
Rockville, Maryland 20857

The Office on Smoking and Health (OSH) is the Department of Health and Human Services' lead agency in smoking control. OSH has sponsored distribution of publications on smoking-related topics, such as free flyers on relapse after initial quitting, helping a friend or family member quit smoking, the health hazards of smoking, and the effects of parental smoking on teenagers.

"In Hawaii, on Oahu call 524-1234 (call collect from neighboring Islands).

Spanish-speaking staff members are available during daytime hours to callers from the following areas: California, Florida, Georgia, Illinois, New Jersey (area code 201), New York, and Texas. Consult your local telephone directory for listings of local chapters.

Health Effects of Asbestos Exposure

Routes of Entry

Primary:

Secondary:

ASBESTOS CANNOT BE ABSORBED THROUGH THE SKIN!

Respiratory System Anatomy

Oral Cavity: _____ and _____
Air Passage to Lungs: _____
Air Passages: _____ and _____
Air Sacs: _____
Chest Cavity Lining: _____

Respiratory System Defenses

Nose: _____
Mouth _____
Air Passages: _____ and _____
Air Sacs: _____

Latency Period for Asbestos-Related Diseases

Asbestosis: _____ Years
Lung Cancer: _____ Years
Mesothelioma: _____ Years
Pleural Effect: _____ Years

Asbestos-Related Diseases

A. Non-Cancerous

1.
2.
3.
4.

B. Cancerous

1.
2.
3.

C. Asbestos and Smoking

Dose-Response Relationship

Asbestosis

Lung Cancer

Mesothelioma

The Doctor's Diagnosis

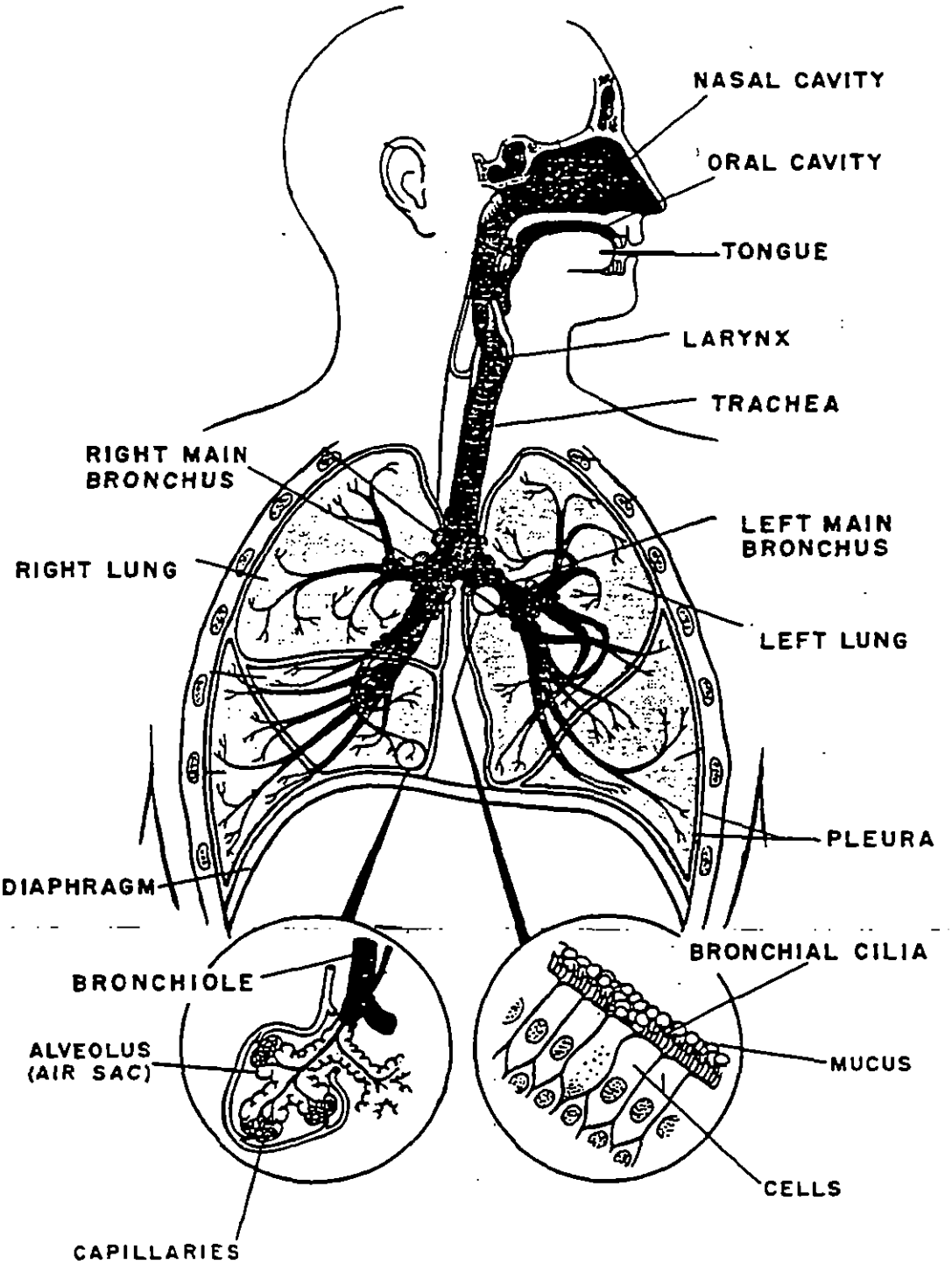
Treatment

Asbestosis

Lung Cancer

Mesothelioma

THE RESPIRATORY SYSTEM



THE RESPIRATORY SYSTEM

This chart of the RESPIRATORY SYSTEM shows the apparatus for breathing. Breathing is the process by which oxygen in the air is brought into the lungs and into close contact with the blood, which absorbs it and carries it to all parts of the body. At the same time the blood gives up waste matter (carbon dioxide), which is carried out of the lungs with the air breathed out.

1. The SINUSES (Frontal, Maxillary, and Sphenoidal) are hollow spaces in the bones of the head. Small openings connect them to the nasal cavity. The functions they serve include helping to regulate the temperature and humidity of air breathed in, as well as to lighten the bone structure of the head and to give resonance to the voice.
2. The NASAL CAVITY (nose) is the preferred entrance for outside air into the Respiratory System. The hairs that line the inside wall are part of the air-cleaning system.
3. Air also enters through the ORAL CAVITY (mouth), especially in people who have a mouth-breathing habit or whose nasal passages may be temporarily obstructed, as by a cold.
4. The ADENOIDS are lymph tissue at the top of the throat. When they interfere with breathing, they are generally removed. The lymph system, consisting of nodes (knots of cells) and connecting vessels, carries fluid throughout the body. This system helps to resist body infection by filtering out foreign matter, including germs, and producing cells (lymphocytes) to fight them.
5. The TONSILS are lymph nodes in the wall of the pharynx that often become infected. They are part of the germ-fighting system of the body.
6. The PHARYNX (throat) collects incoming air from the nose and mouth and passes it downward to the trachea (windpipe).
7. The EPIGLOTTIS is a flap of tissue that guards the entrance to the trachea, closing when anything is swallowed that should go into the esophagus and stomach.
8. The LARYNX (voice box) contains the vocal cords. It is the place where moving air being breathed in and out creates voice sounds.
9. The ESOPHAGUS is the passage leading from mouth and throat to the stomach.
10. The TRACHEA (windpipe) is the passage leading from the pharynx to the lungs.
11. The LYMPH NODES of the lungs are found against the walls of the bronchial tubes and trachea.
12. The RIBS are bones supporting and protecting the chest cavity. They move to a limited degree, helping the lungs to expand and contract.
13. The trachea divides into the two main BRONCHI (tubes), one for each lung, which subdivide into the lobar bronchi—three on the right and two on the left. These, in turn, subdivide further.
14. The right lung is divided into three LOBES, or sections. Each lobe is like a balloon filled with sponge-like tissue. Air moves in and out through one opening—a branch of the bronchus.
15. The left lung is divided into two LOBES.
16. The PLEURA are the two membranes, actually one continuous one folded on itself, that surround each lobe of the lungs and separate the lungs from the chest wall.
17. The bronchial tubes are lined with CILIA (like very small hairs) that have a wave-like motion. This motion carries MUCUS (sticky phlegm or liquid) upward and out into the throat, where it is either coughed up or swallowed. The mucus catches and holds much of the dust, germs, and other unwanted matter that has invaded the lungs and thus gets rid of it.
18. The DIAPHRAGM is the strong wall of muscle that separates the chest cavity from the abdominal cavity. By moving downward, it creates suction in the chest to draw in air and expand the lungs.
19. The smallest subdivisions of the bronchi are called BRONCHIOLES, at the end of which are the alveoli (plural of alveolus).
20. The ALVEOLI are the very small air sacs that are the destination of air breathed in. The CAPILLARIES are blood vessels that are imbedded in the walls of the alveoli. Blood passes through the capillaries, brought to them by the PULMONARY ARTERY and taken away by the PULMONARY VEIN. While in the capillaries the blood discharges carbon dioxide through the capillary wall into the alveoli and takes up oxygen from the air in the alveoli.

The AMERICAN LUNG ASSOCIATION, publisher of this chart, was established in 1904 as the first voluntary health organization devoted to the conquest of a disease (tuberculosis). It now seeks to advance the prevention and control of all lung diseases through education, the improvement of patient care and the development of such preventive measures as conserving unpolluted air and discouraging cigarette smoking. Booklets, posters and other materials and lung disease information are available from local and state lung associations, The Christmas Seal People,® in every part of the United States.

AMERICAN LUNG ASSOCIATION
The Christmas Seal People®

#0950

© AMERICAN LUNG ASSOCIATION

INTRODUCTION TO ASBESTOS ABATEMENT

This section will provide an introduction to the types of abatement methods. Appropriate and inappropriate applications for each method will be discussed.

OUTLINE

I. Introduction To Abatement

- A. Testing Buildings for Asbestos
- B. Location and Accessibility of ACM
- C. Condition of ACM
- D. Present and Future Uses of Building Areas

II. Types Of Abatement

- A. Removal
- B. Enclosure
- C. Encapsulation
- D. Repair
- E. Operations and Maintenance

III. Special Considerations

INTRODUCTION TO ASBESTOS ABATEMENT

The goal of any abatement process is to reduce or eliminate a hazard. In this case, by preventing the release of asbestos fibers. There are many types of abatement, each one suitable for a specific problem. Before we discuss the different types of abatement, let's look at the ways to determine the presence and condition of asbestos in a building.

Buildings are tested for asbestos in two ways, bulk samples and air samples. A bulk sample is a piece of suspect material that is taken by a licensed and certified inspector. The collection of all bulk samples is then sent to a laboratory to be analyzed under a microscope. The analysis method that is used for bulk samples is PLM (Polarized Light Microscopy). Inspectors use air sampling pumps to gather information about airborne asbestos fibers in a particular area of a building. Air samples are also sent to a laboratory to be analyzed under a microscope. There are three analysis methods used for air samples. The most common is PCM (Phase Contrast Microscopy). The most specific for asbestos is TEM (Transmission Electron Microscopy).

Once the results of the samples are known from the lab and it is determined that asbestos is present in a building, there are factors that will influence what abatement or control options are chosen. Those factors include:

- Type of ACM
- Condition and amount of ACM
- Location and accessibility of ACM
- Present and future uses of affected area

Asbestos materials that are friable, have the potential to become friable, or are easily accessible, need to be addressed immediately. Other materials that are in good condition will just need to be monitored over time. The following chart outlines the various abatement options available and some advantages and disadvantages of each.

ASBESTOS ABATEMENT

OPTION	ADVANTAGE/CONSIDERATIONS	DISADVANTAGE
Removal - The removing of all asbestos-containing materials form a building.	Eliminates asbestos permanently. Eliminates need for O&M program. Long-term costs may be lowest. Worker protection and procedures required.	Improper removal may raise fiber levels. Replacement material may be necessary. Encapsulation required. Building operations may need to be shut down temporarily. High cost initially.
Encapsulation - Applying a coating to the asbestos to seal the fibers together. Two types of encapsulants are bridging and penetrating.	Reduces fiber release. Initial costs may be lower. No replacement material required. Worker protection and procedures required.	Must establish O&M program. Asbestos remains in the building. Long-term costs may be high. Asbestos may delaminate from surface. Appropriate situations/conditions for encapsulation are limited.
Enclosure - Constructing an air-tight barrier around the asbestos material. Common materials used are: plaster, dry wall, wood, caulking, PVC, metal jacketing, etc.	Reduces fiber levels outside the enclosure. Initial costs may be lower. No replacement material required. Worker protection and procedures required.	Must establish O&M program. Asbestos remains in the building. Fibers still being released behind enclosure. Periodic re-inspection required.
Repair - Removing, encapsulating or enclosing a small amount of damaged ACM. This also includes clean-up of dust and debris.	Reduces fiber release. Initial costs may be lower. Quick remedy for problem. Worker protection and procedures required.	Must establish O&M program. Asbestos remains in the building. Temporary solution. Periodic reinspection required.
Operations & Maintenance (O&M) An on-going program designed for a building in which service workers safely manage asbestos materials in place.	Lowest initial cost. Workers need to be trained. Documentation system established. Annual medical exams. Equipment inventory maintained.	Asbestos remains in the building. Long-term cost may be high. Periodic reinspection required. O&M work takes more time.

INTRODUCTION TO ASBESTOS ABATEMENT

Two ways that buildings are tested for the presence of asbestos.

1.

2.

Analysis method used for bulk samples.

Analysis methods used for air samples.

Key factors in determining asbestos hazards.

Five Asbestos Abatement Methods to choose from:

1. _____

Pros

Cons

2. _____

Pros

Cons

3. _____

Pros

Cons

4. _____

Pros

Cons

5. _____

Pros

Cons

BACKGROUND OF OPERATIONS AND MAINTENANCE PROGRAMS

This section will discuss the history of asbestos management and control for building owners and service workers. It will define Operations and Maintenance (O&M) Programs as well as identify the goals, objectives and components of O&M programs.

OUTLINE

I. History

- A. EPA Regulation
- B. EPA Guidance

II. EPA Studies

- A. Building Use
- B. Potential Exposures

III. Responsible Persons

- A. Building Owner
- B. Asbestos Program Manager

IV. Goals of an Operations and Maintenance Program

- A. Objectives for Building Service Workers
- B. Components of Comprehensive O&M Programs

BACKGROUND INFORMATION ON O&M PROGRAMS

The Environmental Protection Agency (EPA) has been regulating asbestos since the early 1970's. Since that time, guidance and regulatory documents have addressed the asbestos issue with increasing concern. Asbestos has been widely used in the United States for over 50 years, mainly in the construction industry. Asbestos is a proven human carcinogen (cancer-causing agent) and has received much publicity as to its potential health hazards to building occupants and workers.

In 1988, the EPA estimated that approximately 733,000 public buildings in the U.S. contain some application of asbestos. Most of these buildings contain a friable, spray-applied coating that was used for fireproofing, acoustical insulation, decorative covering or condensate control.

Realizing the abundance of asbestos-containing materials in buildings, and the normal aging and deterioration of these materials overtime, the potential exposure to damaged asbestos by building occupants and workers could be high.

Beginning in 1979, the EPA issued a guidance document for school buildings known as "The Orange Book". This described the various forms of asbestos minerals, their aerodynamic properties, the widespread use of spray-on asbestos coatings, potential environmental contamination as well as contamination in buildings and potential health effects. At this time, asbestos abatement or management was not addressed.

The EPA Blue Book was issued in 1983.
The focus of this guidance document was on how to manage friable asbestos. More information regarding the health effects from exposure to airborne fibers was illustrated as well as increased experience and knowledge on dealing with asbestos in buildings. Key recommendations presented were to sample for the presence of asbestos and determine and implement appropriate control options. One control option is an O&M program. At this time, it was suggested that building service workers should be trained and use special procedures when working around ACM.

The Purple Book of 1985 was the first document to clarify what the specific requirements of an O&M program should be. Key areas mentioned were; notification to building occupants, labeling of ACM, training of building service workers, designation of an asbestos program manager; cleaning of affected areas and bi-annual reinspection of the materials.

These guidance documents, combined with the OSHA final rules in 1986, set the standards for the way in which asbestos was to be handled. Each year new policies, additions to the regulations and improved work practices are introduced into the industry. Lets take a look at the components of an O&M program for the nineties.

Operations and Maintenance programs are an important component of a buildings asbestos management plan. A building owner choosing this abatement option may either coordinate this program directly or assign the responsibilities to an Asbestos Program Coordinator. The goals of an effective program are outlined below:

1. Monitoring asbestos in place to determine existing damage and the potential for future damage of the ACM.

2. Repairing damaged asbestos to prevent the release of airborne fibers.

3. Preventing future disturbance of the materials by anticipating problems that may arise as a result of physical damage, water and/or air erosion or improper work practices.

The intent of an O&M program is not the removal of all of the asbestos from a building, but the maintenance of it in place.

An effective O&M program contains the following components:

Training	-	a minimum of sixteen hours of training as required by various federal, state and local regulations.
Medical Surveillance Program	-	required on an annual basis for those who may be exposed to asbestos at or above the OSHA Action level of 0.1 f/cc over an 8 hour TWA for thirty or more days per year or for those who are required to wear a negative pressure respirator for their job. This program consists of a pulmonary function test (PFT), a detailed health questionnaire, a physical exam and it is recommended that an initial chest x-ray be given to establish a baseline health status for each individual.

Personal Protective Equipment	-	using respirators and disposable clothing to protect oneself and other individuals from exposure to airborne asbestos.
Air Monitoring	-	taking a personal air sample within the breathing zone of the worker during asbestos- related activities as required by OSHA.
Policies and Procedures	-	Specific company asbestos policies and work procedures developed to address the asbestos needs and concerns of each facility.
Safety Equipment	-	special equipment used only for asbestos related work activities. It is maintained and stored separate from other safety or maintenance equipment.
Periodic Surveillance	-	the bi-annual visual inspection and documentation of the condition of all asbestos-containing materials that remain in a facility. For more information, refer to section twelve (12) of this manual.
Documentation and Recordkeeping	-	necessary forms and records that are kept of all asbestos-related activities that occur within a facility. This is not only recommended as good practice, but is a regulatory requirement.

BACKGROUND INFORMATION ON O&M PROGRAMS

Goals and Objective of O&M Programs:

1. Prevent

2. Monitor

3. Repair

Components of an O&M Program:

1. Training

Who _____

How long _____

How often _____

2. Medical Surveillance:

Components _____ _____

_____ _____

Who Needs Medical Surveillance?

a.

b.

How often? _____

3. Personal Protective Equipment

Equipment Needed:

4. Air Monitoring:

Personal

Initial

5. Policies and Procedure:

Developed for _____

Used by _____

Work Procedures:

General - example _____

Specific - example _____

6. Safety Equipment

Equipment used for every job:

a.

b.

c.

d.

e.

f.

g.

7. Periodic Surveillance:

How often _____

Purpose:

a. existing damage

b. future damage

8. Documentation and Recordkeeping:

Documentation Forms:

a.

b.

c. waste manifest

Recordkeeping

How long are each of these kept?

training records	_____	medical exam results	_____
air sampling results	_____	fit-test results	_____

APPLICABLE REGULATIONS

This section will provide an overview of the federal, state and local regulatory agencies that control asbestos materials.

OUTLINE

I. Federal Agencies

A. O.S.H.A. 29 CFR 1926.1101

1. Worker Protection
2. Hazard Communication

B. E.P.A.

1. N.E.S.H.A.P.
2. A.H.E.R.A.

C. D.O.T.

II. State Agencies

III. Local Agencies

APPLICABLE REGULATIONS

The regulation of asbestos has an interesting history because it demonstrates a progressive increase in knowledge leading to a decreasing exposure standard. The regulation process demonstrates many of the forces involved in environmental issues because it is largely a process of negotiations, including debates over scientific proof and risk- and cost-benefit analyses.

One of the difficulties involved in understanding the regulation of asbestos is that there are so many agencies involved. The following is a brief summary of applicable regulations by each of the agencies significant to your work--U.S. Occupational Safety and Health Administration (OSHA), the U.S. Environmental Protection Agency (EPA), and state and/or local agencies.

FEDERAL REGULATIONS

Occupational Safety and Health Administration (OSHA.)

The Occupational Safety and Health Act of 1970 established the Occupational Safety and Health Administration (OSHA) under the Department of Labor. OSHA is responsible for regulating asbestos exposure in the work place, including removal projects.

Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final Rules (General Industry Standard (29 CFR 1900.1001) and Construction Industry Standard (29 CFR 1926.1101)). The OSHA asbestos regulations ,enacted in June 1986, apply mainly to work places where asbestos-containing products are manufactured or encountered in construction, renovation, or demolition activities. However, the regulations can also apply to any workers who may reasonably be expected to be exposed to asbestos in the course of their normal work activities.

The OSHA regulations established two airborne standards for asbestos exposure.

1. At the Permissible Exposure Limit (PEL) of 0.1 f/cc an employer must regulate the area. A regulated area involves, among other things, engineering controls to minimize airborne concentrations, respiratory and other personal protective equipment, and personal hygiene practices including decontamination procedures.

2. At the Excursion Limit (EL) of 1.0 f/cc, the same requirements as for the PEL apply. This air standard is designed to protect workers who may be exposed to asbestos only for short bursts of high concentrations. Such workers include building maintenance workers and automotive brake repairmen.

Hazard Communication Standard - This regulation protects workers by preempting all state and local Right-to-Know regulations and standardizes all Right-to-Know laws and material safety data sheets. Right-to-Know laws apply to any worker who may encounter hazardous materials in the work place. The law gives him the right to request information and training regarding these hazardous substances including topics such as health effects, safety precaution, and personal protective equipment.

Environmental Protection Agency (E.P.A.)

Environmental Protection Agency (E.P.A.)- Government regulation of asbestos in this country began with the birth of the Environmental Protection Agency which named asbestos as a hazardous air pollutant in 1971.

NESHAPs - National Emission Standards for Hazardous Air Pollutants of 1973 under the Clean Air Act regulates construction and waste disposal methods involving asbestos. In particular, it requires that there be no "visible" emissions of asbestos to the atmosphere and that the EPA must be notified before any renovation or demolition begins involving asbestos removal.

Worker Protection Rule - This regulation is practically equivalent to the OSHA asbestos regulations and applies to all workers not covered under those regulations. One main difference, however, is that the EPA rule has notification requirements.

AHERA - The Asbestos Hazard Emergency Response Act was passed by the two houses of Congress and signed by President Reagan in 1986. Part of this legislation mandated the EPA to develop regulations governing identification, evaluation, and control of asbestos-containing building materials in public and private primary and secondary schools. In October 1987, the EPA published Asbestos-in Schools; Final Rule and Notice which requires Local Educational Agencies to:

1. Conduct inspections to identify all locations of friable and non-friable asbestos-containing building materials

2. Develop asbestos management plans for any required periodic surveillance, reinspections, and response (i.e., abatement) actions.

3. Design and conduct response actions sufficient to protect human health and the environment. Response actions may include repair, encapsulation, enclosure, and removal of asbestos-containing building materials.

AHERA requires that each state develop an accreditation program for training and certification of all individuals performing asbestos-related work in schools (i.e., inspectors, management planners, project designers, abatement workers, contractors/supervisors).

In addition, AHERA mandates that an operations and maintenance (O&M) program be established in any school constructed with asbestos-containing building materials.

DEPARTMENT OF TRANSPORTATION (D.O.T.)

The Department of Transportation regulates the transport of hazardous substances. Various requirements established by the D.O.T. include licensing of haulers as well as proper labeling and containerizing of the hazardous substances.

REGULATIONS

I. Federal Regulations

A. OSHA stands for: _____ _____

and _____ _____

Regulations that protect _____

Two Asbestos Standards:

General Industry

Construction Industry

Two Air Standards:

Permissible Exposure Limit (PEL) = _____ f/cc

over _____ hours

Requirements at this level

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Excursion Limit of STEL = _____ f/cc

over _____ minutes

Requires at this level

B. EPA stands for: _____ _____

_____

Regulations that protect _____

1. (NESHAPS) National Emission Standards for Hazardous Air Pollutants

Air Standard: _____ _____

_____

Regulates use, removal and disposal of asbestos

Use:

Removal/Notifications:

Disposal:

2. EPA Asbestos Hazard Emergency Response Act (AHERA)

What schools are covered?

What has to be done?

Model Accreditation Plan

C. Department of Transportation (DOT)

Regulates:

II State Regulations

III. Local Regulations

GENERAL AND SPECIFIC POLICIES AND WORK PROCEDURES

I. PART ONE

A. General Policies

1. Responsible persons
2. Identification of ACM
3. Prohibited activities
4. Scope of work
5. Scheduling
6. Documentation
7. Training
8. Equipment
9. Personal Protection
10. Waster Handling and storage

B. General Work Procedures

1. Work Site evaluation
2. Equipment
3. Personal Protection
4. Isolation of the work area
5. Preparation of the work area
6. Engineering controls
7. Housekeeping
8. Waste handling
9. Final cleanup
10. Documentation

II. PART TWO

A. Specific Work Procedures

1. General safety procedures
2. Above ceiling access
3. Pipe insulation repair
4. Glovebag removal
5. Boiler insulation repair
6. Coring and drilling VAT
7. Pipe gasketing material
8. Electrical wire insulation
9. Clean-up of fallen debris
10. Manhole procedures
11. Entering contaminated spaces
12. Waste handling

ASBESTOS POLICIES AND WORK PROCEDURES

Part I: General Policies and Procedures

A. General Asbestos Policies

The development of asbestos policies is a critical step taken by building management to ensure a safe workplace for employees, and a safe environment for occupants and the public. When policies and work procedures address the various issues and concerns of the building staff, the end result is a staff that is motivated and feels comfortable working in buildings that contain asbestos. The following is a brief discussion of the points that need to be addressed as a matter of policy for each O&M program.

1. Responsible persons — A person is usually designated to be the Asbestos Program Coordinator and has the ultimate responsibility for the success of the O&M program. Sometimes a team of people are appointed depending upon the size or number of facilities covered under the program. Responsible persons can be any of the following: building owner or operator, building manager, chief engineer, maintenance supervisor, safety director, industrial hygienist, etc. For more information, please refer to the section of this manual on Project Supervision.

2. Identification of ACM — The identification and location of asbestos throughout the building is the catalyst for the entire program. There are a number of options building staff have to help them identify suspect ACM. Building survey reports contain information on locations, types, quantities and condition of asbestos and should be kept in a central location for easy access. When no information is available regarding the suspect material, either have bulk samples taken or assume the material is positive.

3. Prohibited activities — There are certain activities that can cause disturbance and subsequent release of asbestos fibers that should be recognized and prohibited by all building occupants. Some examples include:

   a. Do not use a regular vacuum for asbestos.
   b. Do not touch asbestos unless property trained to do so.
   c. Do not sand, saw, drill, cut, core or otherwise impact ACM.
   d. Do not attach hangers, nails, hooks etc. to asbestos covered surfaces.
   e. Do not place furniture or equipment in close proximity to ACM.

4. Scope of Work — Each O&M program must outline the specific scope of work that is intended for the building staff. It should include details such as number of workers per job, amount of ACM to be impacted and reason for impacting ACM. Intent of the work is the most important consideration because it determines whether or not the work is indeed an O&M job.

5. Scheduling — When and where work needs to be done is dependent upon many factors. If the work is in response to a building emergency, it needs to be handled right away. If the job is a routine one, scheduling can be more flexible. Also important is the location of the work in the building. If the job is in a mechanical room, it can be handled during normal work hours. However, if the job is in an area accessible to building occupants, the work should be scheduled during off-hours. The best way to deal with the numerous scheduling conflicts that can arise is to plan for routine tasks involving asbestos and to anticipate what emergencies could occur, so that a pre-established action plan can be followed.

6. Documentation — The Asbestos Program Coordinator should keep records associated with every aspect of the asbestos program. Some records are required by regulations and others are strongly recommended for any necessary follow-up. For information regarding the types of forms needed and the recordkeeping requirements, please refer to the section of this manual on Recordkeeping.

7. Equipment — Asbestos-related work tasks require specialized safety equipment. There is standard equipment that is used for every asbestos job and various items that are used for very specific tasks. An example of a piece of standard equipment is the High Efficiency Particulate Air (HEPA) vacuum. The specialized vacuum cleaner comes in many sizes, shapes and capabilities. It typically has three to four stages of filtration, the final filter being the HEPA filter which is capable of trapping 99.97% of asbestos fibers 0.3μ in diameter or larger. An example of an optional piece of equipment is the glovebag. The glovebag also comes in many sizes and shapes, and is used specifically for pipe insulation removal. For more information about asbestos-related equipment, please refer to the section of this manual on Safety Equipment.

8. Personal Protection — Personal protective equipment including respirators and disposable clothing is required for anyone working with asbestos-containing materials. An important component of an asbestos O&M program is a written respiratory protection program including fit-testing requirements and a medical surveillance program. For more information on personal protection, please refer to the section of this manual on Respirators.

9. Decontamination and Personal Hygiene — To prevent the spread of asbestos fibers outside of the work area, decontamination procedures should be implemented for all personnel and non-disposable tools and equipment. Standard practice is wet-wiping and HEPA vacuuming. Items that have internal contamination should have all openings sealed with duct tape and then stored in a locked and secured area. Personnel should complete their decontamination by proceeding to a washroom and wash their face and hands and shower if possible.

10. Waste handling and storage — Asbestos-contaminated waste may include: polyethylene sheeting, disposable mops, tools and rags, spent respirator and vacuum filters and water. These items must be properly containerized and stored in a locked and secure area until they can be transported to an approved landfill for disposal. A designated area should

be established for waste materials at each facility. For more information regarding waste handling, please refer to Part II of this section.

B. General Work Procedures

General work procedures are steps that are performed for every asbestos-related job that is conducted. These procedures are designed to accomplish the following tasks:

1. Pre-clean the area of any debris.
2. Clear the area of moveable objects
3. Prepare the work area by sealing non-moveable objects and all openings to the work area with poly sheeting and duct tape. Post warning signs to prevent inadvertent entry by unauthorized persons.
4. Install engineering controls such as a HEPA vacuum and wet methods.
5. Perform specific work procedures as necessary.
6. Final clean the work area and perform decontamination procedures of personnel and equipment.
7. Properly containerize and store all asbestos-contaminated waste.
8. Complete project documentation forms.

These basic steps are critical for the success of the job. The better the work area is precleaned and prepared, the easier the final clean-up will be. Also, a prudent job of pre- and post-cleaning will help to minimize and prevent the spread of asbestos fibers outside of the work area.

Part II: Specific Work Procedures

Specific work procedures are those procedures that are developed for many different maintenance activities where asbestos-containing materials may be present. The step-by-step procedures that are presented on the following pages should be followed, as closely as possible. Some of the steps are required by regulations. Some steps may be modified based upon variations for each job and worker knowledge and experience. However, each procedure should be conducted with worker and occupant safety as the highest priority. Remember that the General Procedures are performed in conjunction with each specific procedure. Finally, it is strongly recommended that each O&M job be performed with a minimum of two workers.

The specific work procedures provided on the following pages include:

A. Glovebag Removal
B. Above Ceiling Access
C. Pipe Insulation Repair
D. Boiler Insulation Repair/Removal
E. Coring/Drilling VAT
F. Sanding/Stripping Asbestos Flooring
G. Electric Wire Insulation Removal
H. Tent Enclosures Procedure
I. Manhole Procedure
J. Procedure for Isolating/Entering Crawl Spaces
K. Clean-up of Fallen Debris
L. Waste Disposal

PROCEDURE NO. 01

ACCESSING ASBESTOS-CONTAINING CEILINGS

This procedure is designed to minimize the generation of asbestos dust and debris when the maintenance activity requires disturbance of the acoustical spray-on ceiling.

Follow the General Safety procedures for asbestos related activities in conjunction with the following steps.

1. Construct an enclosure of 6 mil polyethylene sheeting. The enclosure should extend from the floor up to the ceiling. Do not disturb the ceiling. (The use of a pre-fabricated structure is recommended.)

2. Install HEPA vacuum hose into plastic enclosure and secure with duct tape. Turn vacuum on to create negative pressure inside the enclosure.

3. Lightly mist the ceiling area to be disturbed with an airless sprayer.

4. While holding asbestos waste bag close to and directly under the area to be disturbed, gently cut a section with a utility knife or another appropriate tool. The ACM should fall directly into the waste bag. Make sure all ACM is maintained in a wet state.

5. Encapsulate exposed edges of ceiling with encapsulant.

6. Repair ceiling with asbestos-free materials.

7. Lightly mist and HEPA vacuum entire work area. Decontaminate all tools and equipment.

8. Fold polyethylene enclosure into itself forming a bundle. Duct tape to secure poly sheeting.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Portable Mini-Enclosure
15. Wooden or PVC Frame
16. Documentation Form

PROCEDURE NO. 02

REPAIR OF ASBESTOS-CONTAINING PIPE INSULATION

This activity should be conducted if pipe insulation is damaged, creating known or suspect asbestos fiber release. The insulation should be repaired to reduce the immediate hazard.

Perform the general safety procedures for asbestos-related activities in conjunction with the following steps:

1. Pre-clean the area using a wet-mop and/or HEPA vacuum.
2. Place polyethylene sheeting under the pipe area to be repaired.
3. Apply encapsulant liberally to the damaged pipe insulation with a disposable paint brush.
4. Wrap scrim cloth or rewettable fiberglass tightly around the coated area. Cut the wrapping material to fit with a razor knife.
5. Apply a second coat of encapsulant over the wrapping material, being careful to cover the entire area. Enough encapsulant should be used to completely cover the wrap.
6. Allow the encapsulant to dry for 10-12 hours or as directed by the manufacturer.
7. Dispose of brush and poly as asbestos-containing waste.
8. Wet-mop and/or HEPA vacuum the area.
9. Complete the procedure by checking the repaired section of insulation within the next 24 hours. Another coat of encapsulant may be needed.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Paint Brush
15. Liquid Encapsulant
16. Scrim Cloth
17. Rewettable Fiberglass Cloth
18. Documentation Form

PROCEDURE NO. 03

EMERGENCY REMOVAL OF PIPE AND FITTING INSULATION
(Use of Glove Bags)

This activity is considered an engineering control by the Occupational Safety and Health Administration (OSHA). Glove bag removal is done to eliminate the potential exposure hazard resulting form significantly damaged pipe insulation. A maximum of three linear feet is allowed to be removed with each glove bag. Total amount removed shall not exceed 10 linear feet.

Perform the general safety procedures for asbestos-related activities in conjunction with the following steps:

1. Pre-clean the area using a wet-mop and/or HEPA vacuum.

2. Place polyethylene sheeting under the pipe area to be removed.

3. Reinforce the bottom of the bag and sleeves with duct tape.

4. Place all appropriate tools in the glovebag pouch.

5. Slice, from the open end of the bag along the folds, a length longer than the width of the pipe with insulation. Reinforce the cut edges of the bag with duct tape.

6. Fold the bag around the pipe and duct tape the top edges together.

   Note: Leave enough space above the pipe to allow for access to the top of the ACM.

7. Seal the bag around the pipe with duct tape. The seals should be tight to avoid air leakage and strong to hold the bag to the pipe as it fills with ACM.

8. Cut two "X" holes in the bag with a razor knife. (There may be stickers which mark where to cut.)

9. Insert the nozzle of the HEPA vacuum (nozzle covered with duct tape) in one hole and seal it with duct tape.

   Note: DO NOT TURN THE VACUUM ON YET.

10. Insert a smoke tube in the other hole and test the seal of the bag for leaks.

11. Remove smoke tube and insert water sprayer and seal it with duct tape.

12. Insert your arms into the sleeves/gloves of the bag and carefully remove ACM from the pipe.

    Note: Wet the ACM repeatedly as the insulation is removed.

13. Brush and/or wipe the pipe clean to remove any visible residue.

14. Wipe down inside of bag to settle all debris at the bottom.

15. Grab all reusable tools in one hand and invert the sleeve so that the glove is now lying outside of the bag with the tools inside the glove.

16. Twist the sleeve, wrap duct tape around, and cut the sleeve off through the tape. The glove can now be opened in a bucket of amended water and the tools cleaned.

17. Turn on the HEPA vacuum to remove all contaminated air from the bag.

18. Hold an approved pre-labelled asbestos waste bag under/around the glovebag.

19. Twist the bag as close as possible to the pipe and wrap tape around the twist.

20. Remove the bag, one end at a time, from the pipe, and lower it into the waste bag.

21. Seal newly exposed ends of insulation with rewettable cloth or encapsulant.

22. Cut the water sprayer and vacuum away from the bag.

23. Put all disposable personal protective equipment and the poly on the floor into the waste bag.

24. Seal the waste bag.

25. Check the seal on the encapsulated ends of the insulation. Apply more encapsulant, or cloth if necessary.

26. Encapsulate the bare pipe.

27. Wet-mop and HEPA vacuum the area.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Glovebag
15. Rewettable Pipe Wrap
16. Encapsulating Material
17. Tin Snips
18. Bone Saw
19. Smoke Tubes/Bulb
14. Documentation Form

PROCEDURE NO. 04

SPECIAL PROCEDURES FOR BOILER AND TANK INSULATION

The following procedures illustrate steps for both insulation removal and insulation repair. A maximum of 10 square feet of insulation is allowed for either procedure.

A. Insulation Removal

Perform general procedures first, then:

1. Removal of boiler or tank insulation is best accomplished by two persons. One person to cut the insulating material and a second person to continuously wet it.
2. Thoroughly wet and continue to spray the asbestos-containing material.
3. Using a razor knife, make cuts or slits into the insulation and place it into waste bags.
4. Any metal bands or wire that is removed should be folded or placed bundled and wrapped in two layers of polyethylene sheeting. This will avoid puncturing waste bags or lacerating workers.
5. After the material is removed, clean exposed surfaces with a nylon brush and water.
6. Any remaining ACM should then be encapsulated with a latex spray or wettable wrap.

B. Insulation Repair

Perform general procedures first, then:

1. Thoroughly wet the damaged insulation with amended water.
2. Mold rewettable wrap onto/around damaged area.
3. Procedures for pipe insulation repair using liquid encapsulant and scrim cloth may be used here. (See Procedure 04).
4. Final clean the area by wet wiping and HEPA-vacuuming.

EQUIPMENT NEEDED

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Tin Snips/Wire Cutters
15. Encapsulant (Spray and/or Wrap)
16. Documentation Form

PROCEDURE NO. 05

CORING AND DRILLING AND VINYL ASBESTOS TILE

During maintenance activities on vinyl asbestos floor tile, asbestos fibers may be released. The steps outlined below, in conjunction with the General Procedures, will minimize fiber release and exposure.

A. Special Procedures for Coring and Drilling Vat

1. VATs shall be misted prior to any coring or drilling.
2. Drilling and coring tools shall be equipped with HEPA-filtered vacuums. Wet coring and drilling tools are also recommended.
3. Place pieces of floor tile and mastic in asbestos waste bags. Make sure materials are maintained in a wet state.
4. Residual dust shall be wet wiped and HEPA vacuumed.
5. Apply encapsulant to damage floor tiles.
6. Perform decontamination and clean-up as required.

B. Recommended Interim Guidelines for Stripping/Sanding Asbestos-Containing Floor as Presented by the U.S.E.P.A.

1. The floor should be kept wet during the stripping operation. Do not perform dry stripping. After stripping of wax and before application of the new wax, the floor should be thoroughly cleaned while wet.
2. Run the machine at slow speed (about 175-190 rpm) during the stripping operation.
3. The machine should be equipped with the least abrasive pad possible to strip wax or finish coat from asbestos-containing floors.
4. Do not over-strip floors. Stop stripping when the old surface coat is removed.
5. Avoid stripping floors. Stripping should be done as infrequently as possible - perhaps once or twice per year.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. HEPA Drill or Coring Device
15. Documentation Forms

PROCEDURE NO. 06

SPECIAL PROCEDURES FOR REPLACING PIPE GASKETING MATERIAL

Perform general procedures first, then:

1. Pre-clean the area using a wet-mop and/or HEPA vacuum.
2. Place polyethylene sheeting under the pipe fitting area to be removed.
3. Wet down the area of pipe/fitting.
4. Remove the fitting/flange to access the gasket and/or packing material.
5. Wet down the gasket.
6. Remove the gasket with a HEPA Vacuum ready to be used in case of sudden fiber release. Continue to wet the material.
7. Place the gasket, all debris, poly and all disposable personal protective equipment in an approved pre-labeled waste bag.
8. Wet-mop and HEPA vacuum the area.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Documentation Form
15. Appropriate Hand Tools

PROCEDURE NO. 07

REMOVING ASBESTOS-CONTAINING CLOTH WRAPPING FROM HIGH-VOLTAGE CABLES

Because of the unique conditions that PATH employees must work under, many of the general procedures developed for asbestos O&M work in buildings cannot apply. However, the following steps should be followed in order to reduce the potential for fiber release.

1) Before beginning any work activity in manholes, follow all the general work procedures developed by PATH for safely working along train tracks.

2) Ensure that the cable you are going to work on and as many others in the area as possible have been shut down and locked out.

3) When working with asbestos-containing materials, it is important to reduce the flow of air through the area. When it is possible to isolate the work area through the use of a mini-enclosure, such a method should be employed.

4) Whether or not isolation is possible, restrict access to the area by posting the appropriate warning signs at all entrances to the area. Arrange with your supervisor that during the time you are working on the cable wrap, no other work crews shall pass through the area. If other work crews must pass, immediately stop work and clean the area with a HEPA vacuum.

5) When it is deemed feasible by your supervisor to use the glove bag method for removing the asbestos-containing cloth, perform the same steps as if you were removing pipe insulation. However, when using water, use adequate but sparing amounts.

6) When it is not possible to use a glove bag, begin by cleaning the cable and area with a HEPA vacuum.

7) Use a damp sponge or low volume airless sprayer to wet the cloth wrapping thoroughly. Use amended water for this task. This may require a lot of time but should be performed cautiously due to the proximity of live cables.

8) Remove the cloth wrapping, checking to make sure that the wrapping remains wet.

9) Immediately place the wrapping into an approved asbestos waste bag. Wet the waste inside the bag.

10) Wipe the newly exposed wires with a damp cloth or sponge. Then clean the newly exposed areas with a HEPA vacuum.

11) Perform cable splicing activities being careful not to disturb the remaining asbestos-containing materials.

12) Re-wrap the cable using non-asbestos cloth.

13) Close and seal the bag.

14) Perform general clean up and decontamination procedures.

EQUIPMENT NEEDED

1.	Respirator	6.	Airless sprayer	11.	Utility knives
2.	Disposable coveralls	7.	Danger signs	12.	Disposable towels
3.	Disposable gloves	8.	Barrier tape	13.	Asbestos waste bags
4.	HEPA vacuum	9.	Poly sheeting	14.	Glovebag (optional)
5.	Amended water	10.	Duct tape	15.	Documentation form

PROCEDURE NO. 08

CLEANUP OF KNOWN OR SUSPECT ACM DEBRIS AND DUST

Cleanup of known or suspect ACM debris or dust shall include amounts of up to 10 linear or 10 square feet unless otherwise indicated by the Asbestos Coordinator. This activity includes cleanup of fallen dust or debris from an area where it could be hazardous to the occupants of the area or the maintenance personnel working in the area.

Perform the general safety procedures for asbestos-related activities in conjunction with the following steps:

1. Wet the ACM by misting thoroughly with an airless sprayer. In a manner that minimizes generation of airborne dust, scoop the ACM up and place it in an approved asbestos waste bag. Follow general procedures for waste storage and disposal.

2. If small amounts of ACM are present, use the HEPA vacuum to clean up the debris.

3. After removing the ACM, wet-mop and vacuum the area with a HEPA vacuum.

4. Inspect the area for remaining debris before allowing access to the area. Recleaning may be necessary.

Reminder: Do not sweep any asbestos-containing dust or debris.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Documentation Form

PROCEDURE NO. 09

MAINTENANCE AND CLEANING OF HEPA VACUUMS

Specific Procedures for Cleaning of the HEPA Vacuum to be followed in conjunction with the General Procedures include:

Note: Please refer to manufacturer's instructions before use or cleaning.

1. Place HEPA vacuum and all necessary tools in an isolated area.
2. Post warning signs and restrict access by unauthorized persons.
3. Don personal protective equipment, perform respirator fit-checks.
4. Place a sheet of poly on the floor and secure it with duct tape.
5. Place the HEPA vacuum on the poly and wet-wipe all exterior parts. Do not shake vacuum parts or filters at any time.
6. Carefully unlatch the vacuum's clasps. With a water sprayer, lightly spray the inside of the vacuum as you lift the sequence of covers.
7. Remove vacuum bag and filters and immediately place them in labelled asbestos waste bags. Make sure all materials are thoroughly wetted.
8. Wet wipe all components of HEPA vacuum interior and exterior with disposable towels.
9. Rinse vacuum hose with water and bag the water as asbestos waste.
10. Replace vacuum bag, filters and reassemble vacuum.
11. Dispose of contaminated poly, rags and protective clothing in labelled waste bags and seal with duct tape.
12. Wet wipe respirator, remove and decontaminate as specified.
13. Document date and time of cleaning.

EQUIPMENT NEEDED:

1. Respirator
2. Disposable Coveralls
3. Disposable Gloves
4. HEPA Vacuum
5. Amended Water
6. Airless Sprayer
7. Danger Signs
8. Barrier tape
9. Poly Sheeting
10. Utility Knives
11. Duct Tape
12. Disposable Towels/Mop
13. Asbestos Waste Bags
14. Documentation Form

PROCEDURE NO. 10

ENTERING SPECIAL SPACES WHICH MAY BE CONTAMINATED
(Crawl Spaces, Shafts, Pipe Chases, Attics, etc.)

Entering such spaces known or suspected to be contaminated with asbestos should only be done when absolutely necessary. Areas that are excessively contaminated should first be cleaned by an abatement contractor.

Perform the general safety procedures for asbestos-related activities in conjunction with the following steps:

1) Have the confined space tested for suitable breathing air and other conditions which may be dangerous to life and health.

2) Isolate the point of entry by following the same isolation procedures described under Procedure No. 01 for Accessing Ceiling Spaces.

3) If there is visible dust or debris, pre-clean the area around the entry point.

4) If large amounts of debris or contamination are visible, do not enter the area unless absolutely necessary. Notify the Facility Asbestos Coordinator of the situation prior to entering the area.

5) Always wear an approved respirator and double layers of full-body protective clothing (tyvek suits) when entering a confined space with potential asbestos contamination.

6) When leaving the contaminated area, remove the first layer of protective clothing, rolling the clothing inside out as you remove it and dispose of as asbestos waste.

7) If the first suit did not become ripped or torn, then you may leave the area to remove the second suit.

8) If the first suit is torn, remove the second suit before leaving the work area.

EQUIPMENT NEEDED

1. Respirator
2. Disposable clothing
3. Disposable gloves
4. HEPA vacuum
5. Amended water
6. Airless sprayer
7. Poly sheeting
8. Duct tape
9. Barrier tape
10. Danger signs
11. Asbestos waste bags
12. Utility knives
13. Portable frame (optional)
14. Documentation form

PROCEDURE NO.11

ASBESTOS WASTE STORAGE, HANDLING AND DISPOSAL

A. GENERAL POLICIES

1. Storage, handling and disposal of ACM waste will be conducted in accordance with all federal, state and local regulatory requirements.

   a. Asbestos wastes may include but are not limited to:

      - Any asbestos-containing material that has been removed, cleaned or otherwise disturbed as a result of a planned, or unplanned maintenance or renovation activity.
      - Polyethylene sheeting from under or around a work area.
      - Disposable protective clothing.
      - Duct tape.
      - Amended water used to clean tools and the work area.
      - HEPA vacuum bags and filters.
      - Spent respirator filters.
      - Mops or rags used to clean small spills.
      - Materials which may have been contaminated, such as carpet.
      - Asbestos-containing dust or debris.

B. CONTAINERIZING AND LABELING

1. Asbestos-containing wastes shall be maintained in a wet state.

2. During collection, mixing, wetting or handling of ACM, there shall be no visible emissions to the outside air.

3. Seal all asbestos-containing wastes in leak-tight containers. Put materials that will not fit into containers in leak-tight wrapping.

4. Label the containers or wrapping materials with the following:

   a. OSHA warning label as specified under 29 CFR 1910.1001(j)(2) or 1926.58(k)(2)(iii).

   b. Name of the waste generator and the location at which the waste was generated.

   c. DOT label as specified under 49 CFR 171 and 172.

CASE STUDIES

The following Case Study - Work Scenarios represent actual operations and maintenance job tasks that may be encountered by workers in buildings containing asbestos. This group exercise will require class participants to draw on information that has been presented in order to develop strategies for safely conducting assigned job tasks.

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 1

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

A high pressure steam pipe in the mechanical room has burst. It is a cold winter day and this pipe is essential to the building's heating system. Unfortunately, the pipe is insulated with the asbestos-containing block insulation. Your team must repair the pipe.

WORK SCENARIO NO. 1

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 2

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

An office employee has noticed water damage on a ceiling tile above his desk. The tile itself does not contain asbestos, but there is a pipe with asbestos insulation in the space above the ceiling. There is very little space between the suspended ceiling and the pipe, therefore any movement of the ceiling tile will be difficult. Your team must replace the ceiling tile.

WORK SCENARIO NO. 2

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 3

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

While moving a piece of heavy equipment out of the mechanical room, the outside contractor punctured and damaged the insulation on an expansion tank. The damage was discovered after the contractor had departed. The insulation is asbestos-containing and the damage is approximately one foot long and three inches wide. The damage is right next to the warm air intake of the ventilation system for an occupied area. Your task is to repair/patch the damaged portion of insulation on the expansion tank.

WORK SCENARIO NO. 3

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 4

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

You find a small chunk of white powder in the corridor. You know that the exposed ceiling in the corridor is insulated with asbestos, but you are not sure that the fallen debris is fallen insulation. What questions will you ask to determine if the debris contains asbestos? Let us assume that you decide the material is ACM. Your team must clean up the debris safely.

WORK SCENARIO NO. 4

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 5

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

An asbestos-containing gasket must be replaced. The pipe flange is located in an extremely busy basement hallway. Your task is to safely replace the ACM gasket with a non-asbestos gasket.

WORK SCENARIO NO. 5

CASE STUDY - WORK SCENARIOS

SCENARIO NO. 6

Each team of workers will be presented with a work scenario (job task). Each team will be asked to do the following:

1. Read the scenario.
2. Prepare a strategy to perform the task safely.
3. Elect a "secretary" to write everything down.
4. List the equipment needed to perform the job task.
5. Describe the work practices to be used (in proper sequence).
6. Elect a "supervisor" who will report to the class the equipment to be used and how the task will be done.

SCENARIO:

You receive a work order to run computer cable above a suspended ceiling from room "A" to room "B". The ceiling tiles do not contain asbestos, but there is sprayed-on asbestos fireproofing on the ceiling above the tiles. Room "A" is an occupied office space. Room "B" is the computer room and is usually unoccupied.

WORK SCENARIO NO. 6

RESPIRATORY PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment is extremely important for all persons who contact or may contact hazardous substances during their work activities. Protection against asbestos must be addressed in your employer's written respiratory protection program.

OUTLINE

I. Respiratory Hazards

- A. Oxygen Deficient
- B. Toxic Contaminants

II. Respiratory Protection

- A. Air-Purifying Respirators
- B. Air-Supplied Respirators
- C. SCBA

III. Fit and Protections

- A. Fit Check
- B. Fit-Test

IV. Inspection, Maintenance and Storage

V. Protective Clothing

- A. Disposable Coveralls
- B. Safety Goggles
- C. Hard Hat
- D. Safety Boots

RESPIRATORY PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

Selection and Use of Respirators for Asbestos Exposure

Respiratory protection equipment is used to prevent inhalation of hazardous airborne substances and whenever an atmosphere may be deficient in oxygen. Hazardous airborne substances include gases, mists, aerosols and dusts - or particulate matter such as asbestos. Respirators can be classified into one of the following three general types:

- o Passive air purifying or negative pressure air purifying;
- o Powered air purifying, or positive pressure air purifying; and
- o Supplied air.

Each of these three can use a "half" (i.e., mouth and nose), "full" (i.e., mouth, nose, and eyes), or hood type of facepiece. The following is a brief description of each general type of respirator.

Passive air purifying respirators rely upon the ability of a person's lungs to draw air through an air filtering media that removes the airborne contaminant either by mechanical filtration or chemical reaction. The air filtering media must be capable of completely capturing or reacting with the specific contaminant(s), and the person's lungs must be capable of drawing sufficient air through the media for prolonged periods of time. In addition, the air must have the proper amount of oxygen for human respiration and must not contain any other contaminants that would not be removed by the filtering media. This type of respirator also heavily relies upon a face-to-facepiece seal which can cause the respirator to leak if not completely tight. Each respirator facepiece must therefore be custom fit-tested (qualitatively and/or quantitatively) for each person, and then constantly checked for leakage during use.

Powered air purifying respirators (PAPRs) are an improvement to passive respirators because they have a small battery-powered fan or blower which draws contaminated air through the filtering media and delivers clean air to the facepiece, thereby creating a positive pressure. This pressure greatly reduces stress on the person's lungs and the risks of leakage at the face-to-facepiece seal points. PAPRs must have an air flow of at least four cubic feet per minute. PAPRs use various specific replaceable cartridges similar to those used in the passive filtering respirators.

Supplied air respirators (SA) rely upon an independent source of known "clean" air and have a positive pressure facepiece which eliminates stress on a person's lungs and the risk of inward leakage. The source of air is either a compressor (connected to the respirator with variable lengths of air hose) or a small portable pressurized tank as used by scuba divers. The former is called "Type C" supplied air. The latter is known as a self-contained breathing apparatus (SCBA) and is available with tanks that supply from 5 minutes to several hours of air.

Since the source of supplied air can generally be certified "clean", supplied air respirators offer the best protection against inhalation of the air contaminant. Their use may also be mandatory where the work environment's atmosphere does not have sufficient oxygen and/or has too many (or unknown) air contaminants to ensure the effectiveness of filtering media.

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(1) HEPA or High Efficiency Particulate Air cassettes filter out 99.97 percent of fibers 0.3 microns in diameter or larger.

Regulatory Requirements

All respirators used in asbestos-related work must be approved by NIOSH and MSHA for such use. Only respirators equipped with HEPA filters are approved. Some state and local regulations require certain types of respirators for certain types of asbestos abatement projects. OSHA and EPA, however, currently require that the type of respirator be selected based upon the maximum projected or measured airborne asbestos fiber level (or worker exposure level) and the respirator's certified protection factor.

The following table presents the minimum required respiratory protection for given airborne concentration of asbestos according to OSHA.

TABLE OF OSHA-REQUIRED RESPIRATORY PROTECTION*

	Airborne Concentration Not in excess of:		Minimum Required Respirator
A.	1 f/cc (10 x PEL)	A.	Half-mask air-purifying respirator equipped with high efficiency filter
B.	5 f/cc (50 x PEL)	B.	Full-facepiece air-purifying respirator equipped with high efficiency filters
C.	10 f/cc (100 x PEL)	C1.	Any powered air-purifying respirator equipped with high efficiency filters or
		C2.	Any supplied-air respirator operated in continuous flow mode
D.	100 f/cc (1000 x PEL)	D.	Full-facepiece supplied-air respirator operated in pressure demand mode
E.	Greater than 100 f/cc (1000 x PEL) or any unknown concentration	E.	Full-facepiece supplied-air respirator operated in pressure-demand mode and equipped with auxiliary positive pressure self-contained breathing apparatus

* Table D, 29 CFR 1926.1101

Fit-Testing

The effectiveness of a respirator's fit is fundamental to its performance, especially for passive air purifying respirators. Either minor continuous leakage or a single leakage event can result in significant exposure. The fit of a respirator's facepiece can be tested either quantitatively or qualitatively.

Quantitative testing involves using a challenge agent (contaminant) and carefully measuring its concentration inside the facepiece versus inside a special test chamber in which the respirator wearer places his head. This testing is also used to calculate the respirator's "protection factor". Qualitative testing involves protocols using irritant smoke, saccharin, or banana oil to challenge the fit.

Field Checks:

You must also conduct a field check each time you put on a passive air purifying respirator to insure a good seal and warrant against leaks. The field checks involve two procedures: 1) negative pressure check, and 2) positive pressure check.

The negative pressure check involves sealing the HEPA cartridges with hand pressure and breathing in. The mask should suction on the face making it impossible to draw a breath. If a breath can be drawn, the fit of the respirator is poor. Be aware that too much hand pressure on the HEPA cartridges may give a false seal.

The positive pressure check involves sealing the exhalation valve and breathing out. The mask should balloon on the face creating a resistance that should not allow you to emit a normal breath. There should not be any leakage around the nose piece.

Positive and negative pressure fit checks should be done every time the respirator is put on. If one or both of the fit checks fail, take steps to obtain a proper fit. These steps include adjusting the respirator straps to allow a more secure fit, checking the filters for damage, making sure that nothing is inserted between the face and face-piece (e.g. hair), and checking that the respirator is placed properly over the nose and chin. If, after taking these steps, the respirator still cannot pass a positive or negative pressure fit check, use an alternate respirator for which you have been fit-tested.

General Procedures for Respirator Maintenance

Continuous inspection of the respirator is essential. This will identify damage or malfunction before the respirator is used. Be sure to inspect the respirator before putting it on and again when cleaning it. This should be done prior to each use. The respirator should be cleaned and disinfected after each use.

1. Examine the facepiece for:

   a. Excessive Dirt

   b. Cracks, tears, holes or physical distortion of shape from improper storage.

   c. Inflexibility of rubber facepiece (stretch and knead to restore flexibility).

   d. Cracked or badly scratched lenses in full facepiece.

   e. Incorrectly mounted full facepiece lenses, or broken or missing mounting clips.

f. Cracked or broken HEPA filter holder(s), badly worn threads or missing gasket(s) if required.

2. Examine the head straps or head harness for:

a. Breaks.

b. Loss of elasticity.

c. Broken or malfunctioning buckles and attachments.

d. Excessively worn serration on head harness, which might permit slippage.

3. Examine the exhalation valve and inhalation valves for the following:

a. Foreign material, such as detergent residue, dust particles of human hair under the valve seat.

b. Cracks, tears, or distortion in the valve material.

c. Improper insertion of the exhalation/inhalation valve body in the facepiece.

d. Cracks, breaks, or chips in the exhalation/inhalation valve body, particularly in the sealing surface.

e. Missing or defective valve covers.

f. Improper installation of the valve in the valve body.

4. Examine the air-purifying cartridge for:

a. A NIOSH/MSHA-approved asbestos HEPA filter cartridge.

b. Incorrect installation, loose connections, missing or worn gaskets or cross threading in the holder.

c. Cracks or dents in the outside case of the filter or cartridge.

Cleaning Respirators:

You are responsible for the maintenance of your assigned respirator(s). Therefore, proper cleaning and storage must be performed to prolong the life of respirators and maximize their protection capabilities.

The generally accepted cleaning procedure is to first remove the filter cartridge, then thoroughly wash the mask with a mild detergent and warm water using a brush. Rinse the mask thoroughly in clean water and dry in a clean place. Allow the respirator to dry in room air by hanging it up or resting it on a clean surface. When dry, inspect the respirator for residue. Residue appears most often on the exhalation or inhalation valves which can cause leaking or sticking.

Storing Respirators:

When storing respirators, protect against:

1. Dust
2. Sunlight
3. Heat
4. Extreme Cold
5. Excessive Moisture
6. Damaging Chemicals

Do not store a respirator in an area where something may be piled on top of it. The ideal method of storage is to hang the respirator by one of its head straps, or keep the plastic bag it came in for storage. Store cartridges separately.

RESPIRATORY PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

I. Respiratory Requirements Under OSHA

A. 1910.1001

B. 1926.1101

C. 1910.134

II. Respiratory Hazards

A. Oxygen Deficient

B. Toxic Contaminants

1.

2.

3.

III. Types of Respirators

A. Air-Purifying

Negative Pressure

Positive Pressure

Types of Facepieces

B. Air-Supplied Respirators

Type "C" System

Grade D Air

Potential Contaminants

C. Self-Contained Breathing Apparatus (SCBA)

V. Medical Exam Required

Components:

V. Fit and Protection

A. Fit-Check

1. Negative Pressure

2. Positive Pressure

B. Fit-Test

1. Qualitative

a. Challenge Agents

1) _____

2)

3)

b. Exercises

2. Quantitative

Protection Factors

3. Frequency of Fit-Testing

4. Factors Influencing Frequency

VI. Inspection and Maintenance

A. Respirator Parts

1. Facepiece

2. Head Straps

3. HEPA Filters

4. Inhalation Valves (2)

5. Exhalation Valve (1)

6. Exhalation Valve Cap

B. Proper Cleaning and Storing Methods

VII. Approved Respirators and Filters

A. HEPA Filter

1. Color

2. Label

3. Approval Number

4. Length of Use

VIII. Personal Protective Equipment

A. Disposable Clothing

1. Reason It Is Worn

2. Putting It On Properly

3. Removing It Properly

4. Disposed of As ACM

B. Other Safety Equipment Needed

C. Personal Hygiene

THE PORT AUTHORITY

RESPIRATORY PROTECTION PROGRAM

ENVIRONMENTAL MANAGEMENT DIVISION

Revised 7/91

THE PORT AUTHORITY RESPIRATORY PROTECTION PROGRAM

The Port Authority Respiratory Program is designed to protect employees from airborne toxic agents and is administered by the Environmental Management Division.

I. EVALUATION OF THE WORKPLACE

The Environmental Management Division will conduct surveys to determine concentrations of contaminants and maintain surveillance of work area conditions and the degree of employee exposure. The most effective way to reduce exposure to airborne contaminants is to eliminate or reduce the problem at its source. This can frequently be accomplished by enclosure or confinement of the operation, general and local ventilation, substitution with less toxic materials or administrative limits. The use of respirators is the least desirable method of controlling exposure to airborne contaminants due to worker stress, reduced efficiency and increased work time. However, when engineering and administrative controls are not feasible, personnel will be provided with respiratory protection equipment (RPE) when such equipment is necessary to protect the employee. RPE shall be provided which is applicable and suitable for the purpose intended.

II. RPE ELIGIBILITY

RPE eligibility shall be determined by unit management using criteria established by the Environmental Management Division in accordance with current standards. The names of these eligible employees shall be submitted for evaluation to the Port Authority Medical Office by the employees' unit. The Environmental Management Division must be copied on all correspondence regarding the Respiratory Protection Program to maintain a complete and current file on each employee.

III. MEDICAL EVALUATION

The medical standards for use of RPE shall be established by the P.A. Medical Director, based on accepted practice.
Prior to fit-testing and the issuance of RPE, the individual employee must be assessed by the Office of Medical Services to determine if the employee is medically able to use this equipment. The Office of Medical Services will notify the employee, his/her supervisor and the Environmental Management Division of their ability or inability to use RPE. In addition, the employee must be periodically evaluated by the Medical Office, after the RPE has been issued, to assure that the employees' medical status has not changed.

IV. RPE TRAINING AND FIT-TESTING

The Environmental Management Division will decide on the type of

respiratory protection equipment to use for each occupational situation. See Guidelines Attachment A.
RPE Training and Fit-testing sites will be jointly selected by the Environmental Management Division and facility supervisors to accommodate facility scheduling and to minimize employee time away from work.

All negative pressure respiratory protection equipment must be individually fit-tested using Occupational Safety and Health Administration (OSHA) recommended methods. The fit-testing procedures shall be qualitative or quantitative as detailed in Attachment B.

At the time of the fit-test, each employee will be instructed in the proper use, care and storage of the individually issued respirator. Special emphasis will be placed on proper positioning on the face, adjustment of the straps and testing for leaks. Supervisors of personnel who use RPE should be readily familiar with its proper use. Supervisors are obligated to perform periodic spot checks of their employees using respirators to make sure the equipment is being used and maintained properly.
The respiratory protection program will be evaluated on an annual basis to determine training requirements and the adequacy of the RPE provided when compared to periodic monitoring data.

A respirator refit shall be conducted every six months from the initial fit date for those employees who are active participants in the Asbestos Operations and Maintenance Program, as well as those employees determined by the Environmental Management Division to have occupational exposure to lead.

Conditions that may interfere with facepiece sealing, such as a significant change in weight (10% or more), significant scarring in the area of the face seal, dental changes, reconstructive or cosmetic surgery, or any other condition that may affect the seal of the facepiece shall warrant a refit. Refitting shall be done upon request, as scheduled through the employees' supervisor.
No RPE shall be issued to employees for use unless they have been fit-tested.

V. INSPECTION AND MAINTENANCE OF RPE

A. Cartridge Type

1. Respiratory protection equipment shall be inspected before use and cleaned and inspected again at the conclusion of each work period. Pre-moistened individual germicidal wipes will be provided for cleaning the units. Any unit showing deterioration will be replaced.

2. Respirators shall be stored in clean air-tight bags and stored in such a manner that outside pressures shall not distort the facepiece.

3. Respirator cartridges will be changed when there is difficulty in breathing through them or a detectable odor of the chemical is noted by the user.

B. Self-Contained Breathing Apparatus (SCBA)

1. Each SCBA unit shall be inspected monthly, or as specified in Attachment D. Air cylinders shall be fully charged and it shall be determined that the regulator and warning devices function properly. A record shall be kept of inspection dates and maintenance performed on SCBA units. SCBA units must be cleaned and disinfected after use. After inspection and cleaning, SCBA units shall be stored to protect against extreme heat and cold, excessive moisture and dust. SCBA units should be stored so that the facepiece and exhalation valve will rest in a normal undistorted position. This will prevent the elastomer of the facepiece from setting in an abnormal shape thereby impairing its function.

2. Replacement of parts, repair and/or inspection on SCBA units shall be performed only by factory certified personnel. Repair parts shall be manufactured and approved by the SCBA unit manufacturer. All repairs must be performed in accordance with manufacturers' standards and specifications. Field maintenance personnel will perform only those functions for which they are certified.

3. The quality of breathing air shall meet at least the requirements for Grade D breathing air as described in Compressed Gas Association (CGA) Commodity Specification G7.1-1966. The compressor for supplying the breathing air shall be equipped as a breathing air type compressor. It shall be so constructed and situated as to avoid entry of contaminated air into the system. Suitable in line air purifying solvent beds and filters shall be installed to ensure breathing air quality. If an oil lubricated compressor is used, it shall have a high temperature and carbon monoxide alarm. The breathing air shall be tested by an approved laboratory at the ratio of four (4) samples from every seventy (70) cylinders filled to insure that the breathing air meets the CGA Grade D Standards.

ATTACHMENT A

RPE GUIDELINES

1. All RPE must be NIOSH approved for the specific contaminant and its concentration.

2. The oxygen (O_2) concentration of any atmosphere entered must be at least 19.5% if a cartridge type respirator is to be used. (These units do not supply oxygen). If a lesser oxygen concentration is expected, or if the O_2 concentration is unknown, the use of a self-contained breathing apparatus (SCBA) is required. SCBA units are also required for protection against toxic agents with little or no warning properties.

3. All negative pressure respiratory protection equipment will be assigned to individuals for their exclusive use. Replacement units will be kept at the facility on reserve.

4. Respirators shall not be fitted or worn if facial hair comes between the sealing surface of the facepiece and the face or if facial hair interferes with valve function. Also, a proper facepiece to face seal cannot be established if temple bars of eyeglasses extend through the sealing edge of a full facepiece. Therefore, eyeglass adapter kits specified by each manufacturer must be used by those individuals using full facepieces. The use of contact lenses is prohibited when using full face respirators or SCBA units. Use of eye protection such as chemical goggles is recommended when using half-face respirators.

5. Two fit checks shall be conducted by the wearer each time the respirator is donned or adjusted to determine if the respirator is properly seated and that the inhalation and exhalation valves are functioning correctly.

   A. EXHALATION VALVE FIT CHECK

   To conduct this check, place the palms of the hands over the face of each cartridge, inhale and hold your breath for five (5) seconds. If the facepiece collapses slightly and no air leaks between the facepiece and the face are detected, a good fit has been obtained and the exhalation valve is functioning correctly.

   B. INHALATION VALVE FIT CHECK

   This check is carried out by covering the opening of the exhalation valve cap with the heal of your palm and simultaneously exhaling. If the facepiece bulges slightly and no air leaks between the facepiece and face are detected, a good fit has been obtained and the inhalation valves (2) are functioning correctly.

6. RPE is to be used only for the material and concentration authorized by the Environmental Management Division. If, after atmospheric testing of the work area, conditions change, re-evaluation of the RPE is required.

ATTACHMENT B

STANDARD OPERATING PROCEDURE FOR QUALITATIVE RESPIRATOR FIT-TESTING: ISOAMYL ACETATE FIELD TEST - PLASTIC BAG ENCLOSURE

1. Facepieces equipped with organic vapor cartridges will be used for this test.

2. A tissue or cloth is saturated with isoamyl acetate and suspended inside the top of the bag or hood.

3. The test subject will don the respirator and a visual inspection of the facepiece-to-face seal shall be made by the tester. An obvious leak in the facepiece-to-face seal shall be reason to abort the test and record that size mask unsatisfactory. Expression of discomfort created by the mask shall also be reason to abort the test.

4. The test subject will perform an inhalation and exhalation valve fit check as explained in Attachment A.

5. The test subject shall be instructed to enter the bag or hood and breathe normally during a short sedentary period (20-60 seconds). If no leakage is detected by the subject during the sedentary period, the subject shall be instructed to perform various exercises simulating, as near as possible, his/her work conditions (i.e., talking, running in place, head movements, bending over, etc.). Leakage at any time shall be cause to terminate the test.

6. Detection of the odor by the test subject during fitting, indicates a failure of that respirator. If leakage is detected, the subject shall be removed from the test atmosphere and the facepiece-to-face seal visually inspected for obvious leakage. If any doubt about the condition of the facepiece or the cartridges exist, another respirator shall be tested to assure the leakage was due to facepiece-to-face seal.

STANDARD OPERATING PROCEDURE FOR QUANTITATIVE RESPIRATOR FIT TESTING PORTA COUNT PARTICLE COUNTING INSTRUMENT

1. Facepieces equipped with high efficiency particulate air (HEPA) cartridges will be used for this test.

2. The test subject will don the respirator and a visual inspection of the facepiece to face seal shall be made by the tester. An obvious leak in the facepiece to face seal shall be reason to abort the test and record that size mask as unsatisfactory. Expression of discomfort created by the mask shall also be reason to abort the test.

3. The test subject will perform a prescribed number of exercises as requested by the fit tester which shall include deep and normal breathing, head movements, grimacing, jogging, touching toes and the vocalizing of the rainbov passage. The fit tester shall prescribe the required amount of time for each exercise.

4. A fit factor will be attained which is a ratio between the airborne particulate concentrations of the room air and the filtered air inside the mask. Fit factors which are not at least 10 times greater than the assigned protection factor for a negative pressure half or full face respirator shall fail the test. If a failed test occurs, another size respirator shall be donned by the test subject and the entire procedure repeated until a passing fit is recorded.

ATTACHMENT C
STANDARD OPERATING PROCEDURE
DISASSEMBLY, CLEANING AND MAINTENANCE OF RESPIRATORS

1. Remove the cartridges and all gaskets that are not affixed to seats.

2. Visually inspect facepiece and parts. Discard faulty items.

3. Remove all elastic headbands.

4. Remove exhalation valve cover.

5. Remove speaking diaphragm or speaking diaphragms-exhalation valve assembly or pressure-demand exhalation valve assembly.

6. Remove inhalation valves.

7. Wash, rinse and sanitize facepiece. (Maximum water temperature 140°F optimum range 120° to 140°F). Parts removed from respirators may be washed separately as necessary.

8. Air dry masks.

9. Hand wipe facepiece, valves and valve seats with a damp cloth to remove any soap or water residues, mold release powders or foreign materials not removed by washing.

10. Disassemble and hand clean the pressure-demand and exhalation valve assembly, exercising care to avoid damage to the rubber diaphragm.

11. Visually inspect the facepiece and all parts for deterioration, distortion, or other faults that might affect the performance of the respirator.

12. Replace any questionable or obviously faulty parts or assemblies including rubber components that show wear by checking when flexed or stretched, distorting the facepiece. Replace only with parts specifically designed for the particular respirator.

13. Reassemble mask and visually inspect completed assembly.

14. Install new or retested filters or cartridges.

15. Clean and apply fogproof to lens as per the manufacturers' instructions (full facepieces only).

16. Install outside lens cover (full-facepieces only).

17. Seal each mask in a plastic bag.

ATTACHMENT D

CHECKLIST FOR INSPECTION OF DEMAND OR POSITIVE PRESSURE DEMAND OPEN CIRCUIT SELF CONTAINED BREATHING APPARATUS 2.5 WITH MODE SELECT LEVER:

PRIOR TO BEGINNING INSPECTION:

1. Check to assure that high pressure hose connect is tight on cylinder fitting.

2. Check the bypass valve - it should be closed.

3. Make sure the mainline valve is open and locked (when lock present).

4. Place the select lever (if present) on demand mode.

5. Check to assure there is no cover or obstruction on regulator outlet.

I. BACK PACK AND HARNESS ASSEMBLY

A. Straps

1. Visually inspect for complete set.

2. Visually inspect for frayed or damaged straps that may break during use.

B. Buckles

1. Visually inspect for mating ends.

2. Check locking function.

C. Backplate and Cylinder Lock

1. Visually inspect backplate for cracks and for missing rivets or screws.

2. Visually inspect cylinder hold down strap and physically check strap adjustments and lock to assure that it is fully engaged.

II. CYLINDER AND CYLINDER VALVE ASSEMBLY

A. Cylinder

1. Physically check cylinder to assure that it is tightly fastened to back plate.

2. Check Hydrostatic Test Date to assure it is current.

3. Visually inspect cylinder for large dents or gouges in metal.

B. Head and Valve Assembly

1. Visually inspect cylinder valve lock for pressure.

2. Visually inspect cylinders gauge for condition of face, needle, and lens.

3. Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.) Note function of valve lock.

III. REGULATOR AND HIGH PRESSURE HOSE

A. High Pressure Hose and Connector

1. Listen or feel for leakage in hose or at hose to cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.)

2. Visually inspect condition of hose for drying, cracking or gashes.

B. Regulator and Low Pressure Alarm

1. Read pressure on regulator gauge. (Must read at least 1800 psi and not more than rated cylinder pressure.)

2. Close cylinder valve. Ascertain that no obstruction is in or over regulator outlet. Position regulator to observe regulator gauge. Slowly open bypass valve. Air should flow from outlet, and gauge pressure should begin to decrease immediately. Alarm should sound at pressure reading between 650 and 550 psi. (This assures function of bypass valve and low pressure alarm.) After pressure is completely released, close bypass valve.

3. Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5-10 seconds without any loss of air. Next, create a slight negative pressure on regulator and hold for 5-10

seconds. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during the test indicates a leak in the apparatus.

4. Open the cylinder valve.

5. Breathe in using the regulator. Air should be delivered with very slight effort.

6. On units with select lever, place hand over regulator outlet. Select pressure demand mode. Remove and replace hand over outlet in rapid movement. Repeat twice more. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Select demand mode on select lever and remove hand from outlet. At this point, there should be no air leaking from any point on the pressurized unit.

IV. FACEPIECE AND CORRUGATED BREATHING TUBE

A. Facepiece

1. Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

2. Visually inspect the lens for a proper seal in the rubber facepiece, check to see that the retaining clamp is properly in place, and check lens face for cracks, or large scratches.

3. Visually inspect exhalation valve for visible deterioration or build-up of foreign materials.

B. Breathing Tube and Connector

1. Stretch breathing tube and visually inspect for deterioration and holes.

2. Visually inspect connector to assure good condition of threads and for presence and proper condition of O ring or rubber gasket seal.

NOTE: The final test of a facepiece involves a negative-pressure test for overall seal and check of the exhalation valve. When performing a monthly inspection, place the mask against the face and perform the following test. If preparing for use, don the backpack, then the facepiece and use the following procedure.

C. Negative-Pressure Test on facepiece

1. With facepiece held tightly to face or properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5-10 seconds. If negative pressure is not maintained, the facepiece assembly is not adequate and should not be worn.

NOTE: On Scott Pressure-Pak II and IIA facepiece units only, place connector end of the breathing tube approximately 1/4-1/2 inch from palm of hand and exhale. If you notice any air returning through tube, the mask should not be used.

V. STORAGE OF UNITS

1. Replace the cylinder and clean and inspect the unit after each use.

2. Check to see that the cylinder valve is closed.

3. Make sure the high pressure hose connector is tight on the cylinder.

4. Bleed the pressure from the high pressure hose and regulator.

5. Make sure the bypass valve is closed.

6. Make sure the mainline valve is open (When mainline valve lock is present, it should be engaged.)

7. Place the select lever, if present, on demand mode.

8. Check to make sure all straps are completely loosened and laid straight.

9. Make sure the facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals.

NOTE: Any discrepancy should be cause to set the unit aside until repair can be performed by a certified repair person.

ATTACHMENT E

CHECKLIST FOR INSPECTION OF PRESSURE DEMAND OPEN CIRCUIT SELF-CONTAINED BREATHING APPARATUS 4.5 WITH DONNING SWITCH:

PRIOR TO BEGINNING INSPECTION:

Check to assure that high pressure hose connect is tight on cylinder fitting.

I. BACK PACK AND HARNESS ASSEMBLY

A. Straps

1. Visually inspect for complete set.

2. Visually inspect for frayed or damaged straps that may break during use.

B. Buckles

1. Visually inspect for mating ends.

2. Check locking function.

C. Backplate and Cylinder Lock

1. Visually inspect backplate for cracks and missing rivets or screws.

2. Visually inspect cylinder hold down strap and physically check strap tightener and lock to assure that it is fully engaged.

II. CYLINDER AND CYLINDER VALVE ASSEMBLY

A. Cylinder

1. Physically check cylinder to assure that it is tightly fastened to backplate.

2. Check Hydrostatic Test Date to assure it is current. (Within 3 years for composite lightweight cylinders.)

3. Visually inspect cylinder for large dents or gouges in metal.

B. Head and Valve Assembly

1. Visually inspect cylinder valve lock for pressure.

2. Visually inspect cylinder gauge for condition of face, needle, and lens.

III. CYLINDER PRESSURE GAUGE - VIBRALERT ALARM

A. Donning SCBA

1. Check the cylinder pressure gauge for "FULL" indication. If indicated cylinder pressure is below "FULL", recharge cylinder to 4500 psi or replace with a fully charged cylinder.

2. Check the latest cylinder hydrostatic test date to ensure it is current.

W A R N I N G

CYLINDERS WHICH SHOW EVIDENCE OF EXPOSURE TO HIGH HEAT OR FLAME, SUCH AS PAINT TURNED BROWN OR BLACK, DECALS CHARRED OR MISSING, GAUGE LENS MELTED OR ELASTOMERIC BUMPER DISTORTED, SHALL BE REMOVED FROM SERVICE AND RETESTED PRIOR TO RECHARGING.

3. Check that the breathing regulator purge valve (red knob on regulator) is closed (full clockwise and pointer on knob upward).

C A U T I O N

DO NOT USE TOOLS TO OPEN OR CLOSE THE PURGE VALVE. CLOSE OR OPEN FINGER-TIGHT ONLY. ROTATION OF THE PURGE VALVE KNOB LIMITED TO 1/2 TURN.

4. Fully depress the center of the donning switch on the top of the regulator and release.

5. Slowly open the cylinder valve by rotating knob counterclockwise. Listen for Vibralert alarm to actuate and then stop. There shall be no airflow from the facepiece.

6. Don the facepiece or hold the facepiece to the face to effect a good seal.

7. Inhale sharply to automatically start the flow of air.

8. Breathe normally from the facepiece to ensure proper operation.

B. Removing (Doffing) SCBA

9. Remove facepiece from face. Air shall freely flow from the facepiece.

10. Fully depress center of the donning switch on top of regulator and release. The flow of air from the facepiece shall stop.

11. Rotate purge valve 1/2 turn counterclockwise (pointer on

knob downward). Air shall freely flow from the regulator.

12. Rotate purge valve 1/2 turn clockwise to fully closed position (pointer on knob upward). Airflow from regulator must stop.

13. Push in and rotate cylinder valve knob clockwise to close. When cylinder valve is fully closed, open purge valve slightly to vent residual air pressure from system. The Vibralert will actuate as the pressure drops below 1200 psi. When airflow stops, return purge valve to fully closed position (pointer on knob upward).

14. After checking, unit should be placed back into case or walk away bracket, ready for use, with all straps fully extended, cylinder full, purge valve closed and head harness turned back over facepiece.

W A R N I N G

FOLLOW THE ABOVE PROCEDURE EXACTLY. IF THE VIBRALERT ALARM DOES NOT ACTUATE, THE PURGE VALVE DOES NOT ACTUATE, THE DONNING SWITCH DOES NOT OPERATE AS DESCRIBED OR ANY OTHER OPERATIONAL MALFUNCTION IS NOTED, REMOVE THE APPARATUS FROM SERVICE AND TAG FOR REPAIRS.

IV. FACEPIECE AND CORRUGATED BREATHING TUBE

A. Facepiece

1. Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

2. Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, for cracks, or large scratches.

V. STORAGE OF UNITS

1. Replace the cylinder and clean and inspect the unit after each use.

2. After replacing, make sure the cylinder valve is closed.

3. Make sure the pressure hose connector is tight on the cylinder.

4. Check to see that the pressure has been bled off of high pressure hose and regulator.

5. Adjust all straps so that they are completely loosened and laid straight.

6. When storing make sure to protect the facepiece against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals.

NOTE: Any discrepancy found should be cause to set the unit aside until repair can be performed by a certified repair person.

JOBSITE SAFETY

Attention to safety is essential for avoiding personal injury or death. This section addresses those common safety issues encountered during asbestos related job activities.

OUTLINE

I. Electrical Safety

- A. Causes of Electrical Accidents
- B. Safe Work Practices

II. Ladders

III. Scaffolds

IV. Fire Prevention and Protection

- A. Controlling Fires
- B. Preventing Fires

V. Slips, Trips and Falls

JOBSITE SAFETY

ELECTRICAL SAFETY

Electricity has long been recognized as a serious workplace hazard, exposing employees to such dangers as electrical shock, electrocution, fires and explosions. Approximately 10% of all work place deaths are a direct result of its mishandling and, tragically, most of these fatalities could be avoided.

All workers should be aware that the Human Body will conduct electricity (referred to as electric shock). The severity of the shock received is affected by three primary factors: the amount of current flowing through the body, the path the current takes and the time of exposure to the current.

The causes of electrical accidents are usually one or a combination of the following:

- Unsafe Equipment and Installations
- Unsafe Environments
- Unsafe Work Performance

Unsafe equipment and installations include faulty insulation, improper grounding, loose connections, defective parts, ground faults in equipment or unguarded live parts.

The environment becomes a factor when it contains concentrations of flammable vapors, liquids or gases, corrosive atmospheres and wet or damp locations.

Improper work performance may also cause hazards. These include the failure to de-energize electrical equipment while inspecting or repairing, using defective tools and inadequate maintenance of equipment which has been allowed to deteriorate.

Safe work practices need to be strictly adhered to and include:

- Identify and de-energize all electricity.
- Check all electrical equipment.
- Use non-conductive equipment where possible (rubber scrapers, wooden ladders, etc.).
- Use insulated boot and gloves.
- All equipment/circuits should be grounded.
- Take care! Do not damage electrical equipment.
- Keep electrical wires off the floor.
- ALWAYS CONSIDER EQUIPMENT ENERGIZED UNLESS TESTED.

LADDERS

The following safety rules should be observed when working with ladders:

- Do not use defective ladders.
- Ladders should be finished with varnish or shellac, not paint. Paint hides defects.
- For maximum stability, place straight ladders with the base out one-fourth the distance to the top support.
- Never carry materials while climbing a ladder. Pull material up with a securely attached rope.
- Straight and extension ladders must be equipped with safety shoes. Never use the top half of an extension ladder separately unless it has safety shoes.
- Never use metal ladders near electric wires, transformers, buss bars or other hot electrical circuit exposures.
- Place ladders on solid floors or ground only. Never increase their height by placing them on elevated objects. Ordinary ladders should not be used as horizontal members of a scaffold.
- When using a ladder on roofs or other high places or where there is danger of the ladder slipping or sliding, lash it securely top to bottom.
- Do not lean ladders against windows. Fasten a crosspiece at the top of the ladder to provide a solid support against the wall.
- Do not reach out from a ladder. Move it frequently. Keep both feet on the rungs. Keep one hand on the nearest side rail.
- Keep ladders (especially rungs) clean and free from oil and grease.
- Only one person at a time should be supported by a straight or an extension ladder.
- Always face the ladder when going up or down.
- Avoid laying loose tools on a ladder, or nearby edges. Use tool holders.
- Ladders 18 feet or longer should be carried by two men.
- Never use a step ladder as a straight ladder.
- For good support, stand at least two steps down from the top of a step ladder and at least four steps down from the top of a straight or extension ladder.
- When carrying a long object such as a ladder or a pipe, keep the front end high, the back end low and watch out for overhead obstructions.
- Work should not be performed behind a closed door which can be opened toward the worker. Lock or block the door.

- Do not repair defective ladders - cut up and dispose of the pieces.
- Grasp side rails when ascending or descending ladders. Don't hang onto rungs as hand holds.

SCAFFOLDS

A scaffold is a elevated work platform for supporting workers and materials. They are classified according to load carrying capacity as light, medium and heavy with maximum loads of 25, 50 and 75 pounds per square foot respectively.

Scaffold should confirm to the following:

- Footings must be level, sound, rigid and able to support the maximum load.
- Guardrails, midrails and toeboards must be installed on all scaffolds more than 10 feet above the floor and all mobile scaffold less than 45 inches wide and more than 4 feet above the floor.
- Scaffolding should be screened between the toeboard and guardrail if persons must pass underneath.
- Diagonal and cross bracing should be provided.
- Planking and platforms should overlap a minimum of 12 inches.
- Safe access should be provided.
- Poles, legs or uprights should be plumb.
- Scaffolding height should not exceed 4 times the minimum base dimension.
- Scaffold should be placed as near to walls as possible and securely tied to the structure if the height exceeds 25 feet.
- Do not ride on mobile scaffolds or use mobile scaffolds to move equipment.
- Mobile scaffold must have caster brakes that are used at all times (except when moving).

FIRE PREVENTION AND PROTECTION

Fires are a result of the combustion of materials that is intense enough to emit light and heat. The process involves the combination of four elements; fuel, oxygen, heat and a chain reaction. Take away any of these four elements and the fire is prevented.

Controlling fires involves any/all of the following:

Cooling:	Removing heat at a greater rate than the heat is evolved.
Limiting Oxygen:	Smothering the burning area with a non-combustible material.
Removing Fuel:	Taking fuel from the fire is not only difficult but dangerous unless the fuel can be pumped away, shut off, or diluted.
Interrupting the Chain Reaction:	Prevention of "pyrolysis" through the use of chemical reactants such as dry chemical or halogenated hydrocarbon extinguishing agents.

Fire prevention proposes to reduce the incident of fire loss-injury, loss of life, property loss, etc. through the elimination of ignition of flammable materials. The main causes of fire are: Electrical Problems, Smoking, Friction, Overheated Materials, Hot Surfaces, Flames (i.e., burners, pilot lights), Sparks (mechanical, cutting, welding), Molten Materials, Spontaneous Combustion and Lightning.

The six main fire prevention measures are:

- Preventing dangerous mixtures.
- Elimination of hazards associated with smoking cigarettes.
- Bonding of materials to eliminate the difference in potential between objects (prevents sparking).
- Grounding materials to eliminate the difference in potential between objects and the earth.
- Use of approved electrical equipment.
- Use of spark resistant tools.

Fire hazards in buildings include; smoke and hot gases (75% of deaths), heat and flames (25% of deaths) as well as the building elements and contents. Contingency plans should be drawn up to account for all types of emergencies. These should include emergency evacuation plans that indicate emergency exits, travel routes and assembly points. Emergency exits must be available from every work area (in addition to an alternative). These exits should be clearly marked with adequate emergency lighting of both the exits and the paths of travel. Both the emergency exits and the routes of travel are to be kept clear at all times. Assembly points need to be established outside work areas so that all employees can be accounted for after an emergency.

SLIPS, TRIPS AND FALLS

Yearly, more than 12,000 people lose their lives from slips, trips and falls. In fact, Falls are the most prevalent cause of work related injuries accounting for 30% of all incidents where an employee loses more than one week of work, and 16% of all work related deaths.

Slips

For an operator to "slip" on a surface the Dynamic Coefficient of Friction must be at an unsafe level. The Dynamic Coefficient of Friction is a measure of the grip between two surfaces (weight acting downward vs forward/backward movement along surface), generally the soles of your shoes and the work floor/platform. In general, if the Dynamic Coefficient of Friction is less than 0.4 an unsafe condition is likely to occur and if the Dynamic Coefficient of Friction is above 0.5 slips should not occur.

All operators should note that water significantly decreases the grip between two surfaces (well below 0.4) and good work shoe soles greatly increase the grip between surfaces (generally above 0.5 depending on the surface and its condition). Surface grip is decreased by poor housekeeping through accumulation of dusts and debris.

Trips

Trips at a work place are a result of either:

1. Carelessness; or
2. Poor Housekeeping

It is employee's responsibility to ensure that all work places accessways are maintained in a clean and orderly state. One of the main causes of workplace trips are hidden hazards resulting from a failure to clean a work area.

Falls

Incidents involving falls involve the use of inadequate work platforms or work practices. Work platforms are described in the sections on Scaffolding and Ladders. Operators should only use work platforms that have been specifically designed for the particular task. Do not use supplemental equipment, such as chairs, as a work platform.

Poor work practices that result in falls can be easily prevented. Generally, they are caused by overreaching or use of inadequate equipment.

HEAT ILLNESSES

High temperature and humidity have an adverse effect on job performance. Numerous studies have been documented citing that individuals working in high-temperature environments become irritable, tire easily, make frequent mistakes, and have poorer concentration.

The effects of heat on job performance are dependent on the following factors: intensity of the heat, duration of exposure, tasks involved, person performing the task, and the presence of other stresses*.

Individuals that work with asbestos during their routine activities are influenced by three to all five of these factors. Most of the work is performed in mechanical or boiler rooms where temperatures and humidity can be very high. The activities are often labor-intensive, and special equipment and nonporous clothing are used which contribute to heat stress conditions.

There are three heat stress conditions of primary concern: heat cramps, heat exhaustion, and heat stroke.

Heat cramps are muscle cramps or spasms that occur primarily in the abdomen and extremities. Other signs and symptoms include sweating and vomiting. Heat cramps are usually an early sign of heat exhaustion. This condition results from overexertion and loss of body fluids, especially electrolytes. First aid for heat cramps includes replacing essential fluids, massaging cramped muscles, and resting in a shaded or air-conditioned environment.

Heat exhaustion results from any one or combination of the five previously mentioned factors. Symptoms include profuse sweating, pale skin that is cold and clammy to the touch, nausea, vomiting, dizziness, and weak pulse and breathing. First aid for heat exhaustion includes replacing essential fluids, removing or loosening hot, restrictive clothing, and resting in a shaded or air-conditioned environment. If more serious symptoms such as loss of consciousness appear, the victim should receive medical attention.

Heat stroke is the most serious of the heat stress conditions. It is a life-threatening emergency that requires immediate medical attention.

Heat stroke occurs when the cooling mechanisms of the body shut down. This results in an increased body temperature of 104°F or more, which can ultimately cause brain damage and death. Symptoms include dizziness, weakness, hot/dry skin, blurred vision, vomiting convulsions, and loss of consciousness. It is imperative that the victim be cooled quickly by placing in a cold bath or shower, fanning, and given cold water to drink if conscious and not vomiting. Always transport to an emergency facility for complete treatment.

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* J.F. Wing, "A Review of the Effects of High Ambient Temperature On Mental Performance", Aerospace Medical Research Labs, AD 624-144, September 1965."

PERIODIC SURVEILLANCE

Periodic Surveillance is a "state-of-the-art" work practice referenced in the E.P.A. - A.H.E.R.A. regulation. This section briefly identifies the components of periodic surveillance and how it can be effectively incorporated into an operations and maintenance program.

OUTLINE

I. Detection of Deterioration or Damage of ACM

II. Indications of Potential for Damage

- A. Air Erosion
- B. Water Damage
- C. Physical Damage

III. Recommendations for Response Actions

PERIODIC SURVEILLANCE

Periodic reinspection of ACM in a building is an important component of an O&M program. The reinspection is usually a visual inspection and can be performed by a trained building service worker. This process involves three key components:

1. Detection of any deterioration or damage that has occurred to the ACM.

2. Indications of potential for future damage:

   (a) air erosion;
   (b) water damage;
   (c) physical damage.

3. Recommendations for response actions for any damaged asbestos.

It is recommended that the visual surveillance of the asbestos be conducted every six months. The results of the periodic surveillance exercise are important for the building owner and occupants, therefore, an organized recordkeeping and documentation system should be established. Documentation forms are filled in as the visual walk-thru is done. This will provide a continuous reference source to the locations and conditions of the ACM in the building. Photographs and videos of the ACM over time can also be a valuable indicator as to past and current conditions.

A supplement to periodic surveillance is air sampling. This is not required but may provide additional data as to early warning signs of damage or deterioration of the ACM. To detect early signs of airborne fibers, a baseline asbestos level should be established. Air samples should be taken periodically and representative of many situations to get an idea of the normal fiber levels in a building. The air samples that are gathered should be analyzed by TEM (Transmission Electron Microscopy). TEM is the only analysis method that will differentiate asbestos fibers from non-asbestos fibers or particulates. TEM can also detect very tiny asbestos fibers that other methods cannot. One drawback to this analysis method is that it is very expensive. A negative aspect to using air sampling to detect building changes is that in many cases, sampling results alone will not always give an accurate picture of building conditions.

Examining settled dust for accumulations of asbestos fibers is another assessment method currently being experimented with as part of an O&M program. Although building owners may also gain additional information through this process, no universally accepted standardized protocols currently exist for sampling and analysis.(1)

(1) USEPA Draft; Managing Asbestos in Place, November, 1989.

REVIEW QUESTIONS

1. What is the primary route of entry for asbestos fibers?

2. What is the name of the classic occupational lung disease caused by asbestos?

3. How efficient is a HEPA filter?

4. Why should ACM debris be kept wet?

5. What is a fit check?

6. What is a fit test?

7. What is a surfactant? Why is it used?

8. What factors can affect a proper face seal on a respirator?

9. How often should a fit-test be performed?

10. What is the primary purpose of a Tyvek or protective suit?

11. What happens when the Permissible Exposure Limit (0.1 f/cc) is reached?

12. Why is dry sweeping of ACM absolutely forbidden?

13. What engineering controls are used for all operations and maintenance work?

14. What are the characteristics of asbestos fibers?

15. What are some common uses for asbestos?

16. What are the two methods in which buildings are tested for asbestos?

17. What do the terms friable and non-friable mean?

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18. What is amended water?

19. How does cigarette smoking affect the lungs natural defenses?

20. What are the goals of an Operations and Maintenance Program?